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Preliminary Geothermal Exploration at the Marine Corps Air Ground Combat Center, Twentynine Palms, California

by

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and
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FOREWORD

This report documents studies conducted from 1978 to 1984 on the potential for geothermal resources at the Marine Corps Air Ground Combat Center (MCAGCC), Twentynine Palms, Calif. The studies, which were funded by the Naval Civil Engineering Laboratory, Port Hueneme, Calif., were performed by the Naval Weapons Center (NWC), China Lake, Calif. NWC is the lead Navy activity conducting research to determine geothermal energy potential at Naval and Marine Corps installations and to assess the viability of geothermal energy as an energy resource.

Extensive geological, geophysical, and geochemical investigations were made at select locations at MCAGCC, Twentynine Palms, and temperature measurements were taken from seven thermal-gradient holes. Although the existence of a high-temperature resource on MCAGCC-controlled lands cannot be precluded, results of studies indicate that a low-temperature resource exists in the vicinity of the Main Camp/Administration Area on the southern border of MCAGCC; further work is recommended to determine the origin, extent, and depth of the low-temperature resource at this site. Further work is also recommended at Lavic Lake on the north ranges, where a separate geothermal resource of unknown extent and temperature is suspected.

This report was reviewed for technical accuracy by Carl F. Austin and Steven C. Bjornstad.

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(U) This report discusses the geological, geophysical, and geochemical investigations performed at the Marine Corps Air Ground Combat Center (MCAGCC), Twentynine Palms, near the town of Twentynine Palms, Calif., to determine the existence and extent of geothermal resources on MCAGCC-controlled land. This effort was undertaken in the interest of finding alternative methods of providing energy for a rapidly growing military community. Exploratory thermal-gradient holes revealed a low-temperature resource in the Main Camp/Administration Area on the southern border of MCAGCC. Further exploration is recommended to assess the origin, extent, and depth of this resource and to determine the existence of another, suspected geothermal resource site at Lavic Lake, on the north ranges of MCAGCC, Twentynine Palms.

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The authors express their appreciation to Ralph Brown and S. Sgt. William Flummerfelt of the staff of the Installations Division, Marine Corps Air Ground Combat Center (MCAGCC), Twentynine Palms, Calif. The untiring efforts of these two gentlemen allowed the project to progress as far as it did. Also, we would like to thank the unnamed Marines who made our field work on MCAGCC as pleasant as possible.

Special thanks go to Dennis Trexler and Thomas Flynn of the University of Nevada, Las Vegas, for the excellent work and patience they showed on the drilling phase of the project. Thanks go also to John Crawford of the Department of Energy for setting up the MCAGCC drilling program.

Last, but not least, thanks go to the field crews: Jack Neffew, Kathy Danti, Ted Mort, Terry AtienzaMoore, Becky Cowan, and Jeff Roquemore. Without their assistance and comradery, this project would never have been so enjoyable.

INTRODUCTION

The Main Camp/Administration Area for the Marine Corps Air Ground Combat Center (MCAGCC), Twentynine Palms is located approximately 6 miles north of the town of Twentynine Palms, Calif. (Figure 1). The Center encompasses approximately 1000 square miles and has the largest land holdings of any Marine Corps installation in the world (Figure 2). As of 1985 the Center had a working population of 9000 Marines and 1000 civilians, but the total Marine presence in the area, including Marine families, is approximately 15,000. Another 2100 Marines will be incorporated into the Center's population by 1989. As a result of the expected increase in Marine population, approximately $133 million has been allocated for new construction through the year 1989 (Ghusn and Flynn).

Realizing the growth that MCAGCC would be making, the Naval Civil Engineering Laboratory (NCEL), Point Hueneme, Calif., tasked the Geothermal Program Office (GPO) in the Public Works Department of the Naval Weapons Center (NWC), China Lake, Calif., to provide information on suspected geothermal resources reported in the MCAGCC area. It was hoped that if plentiful, low-temperature geothermal fluids were available beneath MCAGCC-controlled lands, these fluids could be used to help offset cooling and heating expenses at the Center.

Extensive geological, geophysical, and geochemical investigations at several locations gave promising results; measurements taken at seven thermal-gradient holes revealed a geothermal resource having a minimum temperature of 67°C (153°F) near the Main Camp/Administration Area on the southern border of MCAGCC. Another geothermal resource is suspected near Lavic Lake, on MCAGCC's north ranges.

PREVIOUSLY PUBLISHED WORK

The existence of naturally occurring hot water in the area around Twentynine Palms was known to area water-well drillers long before water studies began in the late 1950s and early 1960s. At that time, Bader and Moyle (1960) published data on water wells and springs in the Yucca Valley–Twentynine Palms area that indicated numerous wells with higher than normal temperatures, the highest being 118°F just north of the town of Twentynine Palms.

The first known report to the Department of Defense on the subject of geothermal resources at MCAGCC was published by Combs in 1973. In his report, Combs concluded that "because of the high temperature wells located in the vicinity of the Marine Corps Training Center. . . and because of the very recent Amboy and Pisgah Craters and their associated extensive lava fields [located on the north ranges of MCAGCC]" further work was needed to determine the existence and extent of potential geothermal resources in those areas.

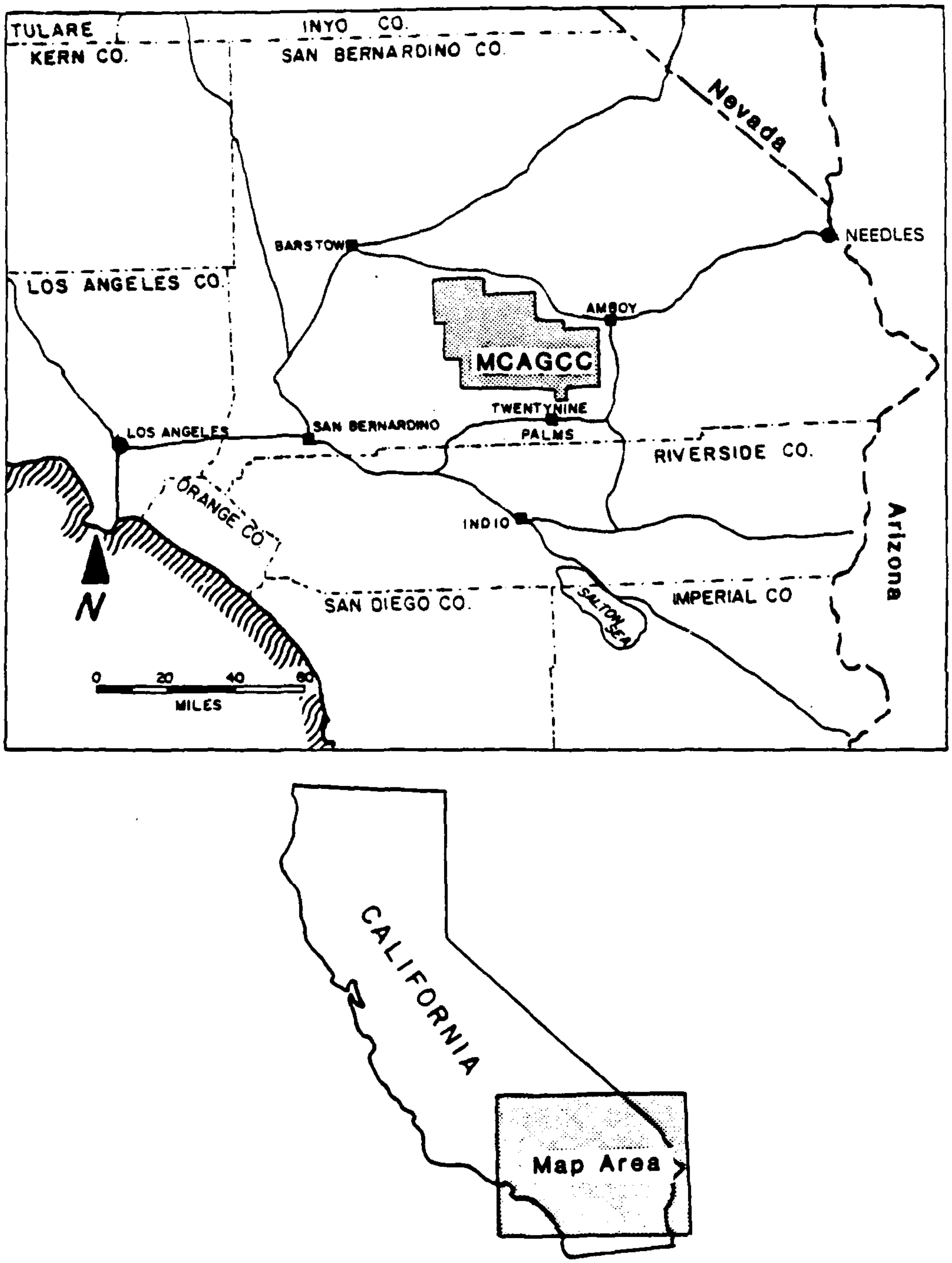


FIGURE 1. Location Map of the Marine Corps Air Ground Combat Center (MCAGCC), Twentynine Palms, Calif. Modified from Trexler and others, 1984.

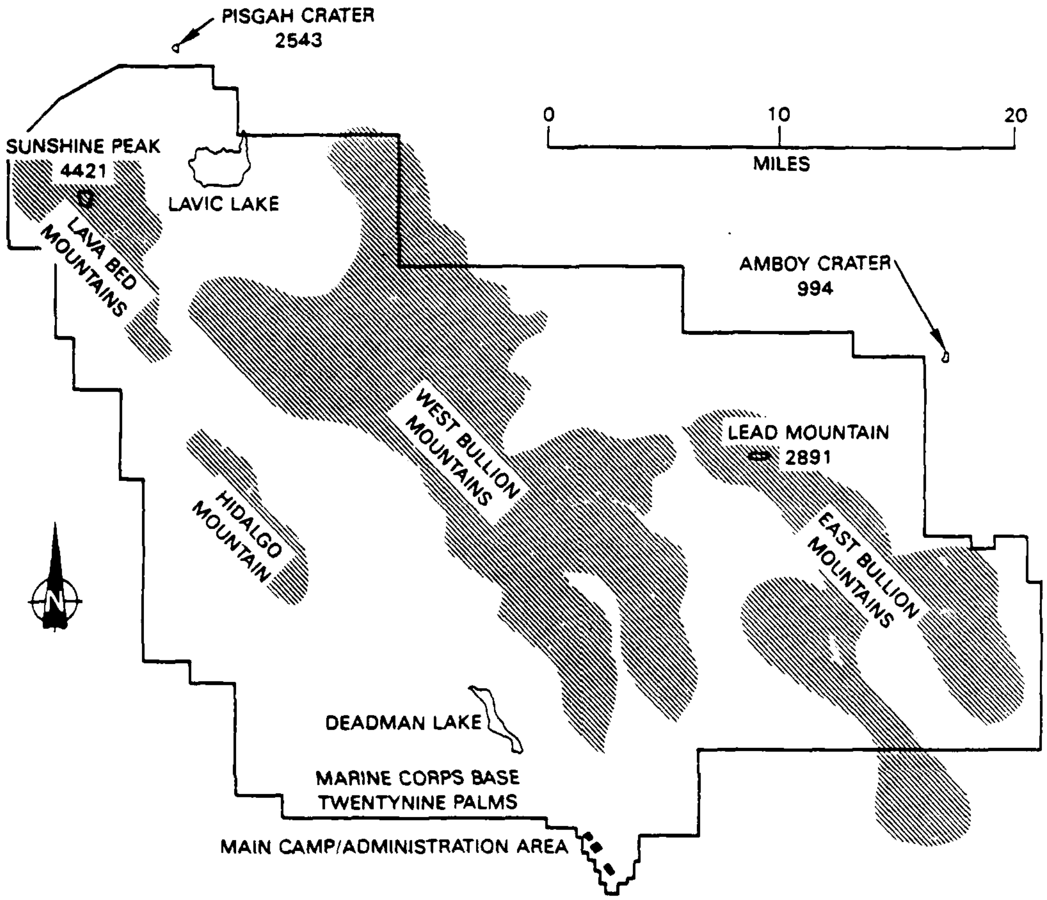


FIGURE 2. Map of MCAGCC-Controlled Lands.

In 1980 the California Division of Mines and Geology, in conjunction with the California Department of Conservation, published the map of Geothermal Resources of California (Higgins, 1980). On this map Higgins reported "at least half a dozen known hot water wells (50 to 60°C) near the town of Twentynine Palms indicate an undeveloped resource." In 1981, Leivas and others reported on two other wells in the area (Jewell and Zuncich) with warmer than normal temperatures. In this report, Leivas concluded that "based upon the meager evidence provided by five known thermal wells in the area, and a cursory study of water resource tables, it appears that the thermal zone may extend for about 15 km in an east-west direction, and as much as 6 km north-south. It appears that deep seated hot waters are rising along two or three known faults, the Mesquite Lake fault, the Pinto Mountain fault, and an unnamed fault extending northwestward from the center of Twentynine Palms." Water levels are substantially lower on the eastern side of the Mesquite

Lake Fault, indicating a barrier to groundwater movements. Leivas reported a personal communication from Moyle that temperatures are also higher on the eastern side of the Mesquite Lake Fault. Leivas was quick to point out, however, that this "observation is supported only by temperature data from one well east of the fault and meager information on temperature/depth relations on the opposite side of the fault."

In 1984, Wahler Associates published an in-depth geotechnical study of the area immediately surrounding the Main Camp/Administration Area, which included geological and geophysical surveys. The study was initiated to investigate geologic and soil-foundation phenomena that might adversely affect the Center. Although not directly related to geothermal resources, the study did provide valuable information concerning the exact location of numerous faults in the Main Camp/Administration Area. Also in 1984, Moyle published a Bouguer gravity anomaly map of the Twentynine Palms area including the Main Camp/Administration Area and the southern part of the Center's ranges. Moyle used the gravity information and the reported depth of selected drill holes and water wells to model the thickness of sediments overlying the basement complex of igneous and metamorphic rock. Results of this study are discussed in the Gravity section of the Site-Specific Studies: Main Camp/Administration Area section of this report.

Trexler and others, in 1984, published the results of thermal-gradient drilling at MCAGCC, Twentynine Palms. The drilling was funded in large part by the Navy and will be reported in detail in the Field Studies: Thermal-Gradient Drilling section of this report.

In 1985 the URS Corporation published a report prepared for San Bernardino County that delineated four geothermal areas that would require further study near the town of Twentynine Palms. The geothermal heat from these areas would presumably be used for space heating and cooling of low-cost housing.

THE NAVY'S GEOTHERMAL EXPLORATION EFFORT

The Geothermal Utilization Division, now the Geothermal Program Office, at the Naval Weapons Center, China Lake, Calif., began active interest in exploration of MCAGCC, Twentynine Palms late in 1978. Field work commenced in April 1981 when data were gathered from 373 gravity and ground-magnetic stations near and around the Surprise Springs area directly west of Deadman Lake. In September 1982 aeromagnetics were flown over the western two-thirds of the Center by Aerial Surveys, Ltd. for Meiiji Resource Consultants, Salt Lake City, Utah. Also in September 1982, data from 214 gravity and ground-magnetic stations were gathered at Lavic Lake in the extreme northern portion of the Center just southeast of Pisgah Crater. In March 1983 the Deadman Lake gravity and ground magnetic study was expanded to include the area east and south of the lake including the Main Camp/Administration Area, and an area between the Center and the town of Twentynine Palms. And, as mentioned previously, early in 1984 seven 1000-foot thermal-gradient holes were drilled around the Main Camp/Administration Area and the area near Deadman Lake. The drilling was a joint effort by the Navy and Department of Energy.

Each of these studies will be explained in detail in the Site-Specific Studies and Field Studies sections of this report.

GEOGRAPHY

LOCATION

The Marine Corps Air Ground Combat Center (MCAGCC) at Twentynine Palms lies within the Mojave Desert in south-central California. The Center is located roughly half way between the Los Angeles Metropolitan Area and the Colorado River at Needles (Figure 1).

Figure 2 is a map of the land controlled by MCAGCC, Twentynine Palms. The West Bullion Mountains are the largest physiographic feature within the Center and cut the Center roughly in half from north to south. East of the West Bullion Mountains lie Lead Mountain, the East Bullion Mountains, and the Amboy Crater area. West of the West Bullion Mountains lie the Lava Bed Mountains, Hidalgo Mountain, Emerson Dry Lake, Lavic Lake, Pisgah Crater, Sunshine Peak, Rainbow Canyon, Gays Pass, Sand Hill, and the Main Camp/Administration Area. The Main Camp/Administration Area and the Lavic Lake area are geothermal sites that have been explored and are discussed in the Regional Geophysical Studies-Aeromagnetics, Site-Specific Studies: Lavic Lake, and Field Studies: Thermal-Gradient Drilling sections of this report.

Twentynine Palms is located in the high desert region of southern California. The climate is characterized by hot summers, cool to cold winters, large diurnal-temperature ranges, low humidity, and little cloudiness or visibility restrictions (Reddick, 1983). Maximum precipitation falls in January and February with total precipitation ranging from approximately 2 to 8 inches for the entire year.

Table 1 presents the long-term mean monthly precipitation levels and the 1981 mean values recorded for Twentynine Palms (Reddick, 1983).

The mountains of the transverse range (the San Bernardino Mountains, in this case) form a barrier to passing storms and frontal systems forming a rain-shadow effect over the Twentynine Palms area (Reddick, 1983). As a result, precipitation varies from 10 to 26 inches on the windward side of the San Bernardino Mountains to about 4 inches annually near Twentynine Palms.

REGIONAL SETTING

The Marine Corps Air Ground Combat Center is located within the Mojave Desert geologic province. As defined by DeCourten (1979) and as seen on Figure 3, the province is bounded on the west by the Garlock Fault along the Tehachapi and southern Sierra Nevada Mountains, and the San Andreas Fault along the San Gabriel and San Bernardino Mountains. The eastern boundary is more obscure; DeCourten arbitrarily places this boundary at the Colorado River and the California-Nevada state line. The northeastern

boundary is defined by the extension of the trend of the Garlock Fault through the Shadow Mountains and Clark Mountains to Nevada. The indistinct southeastern boundary is defined as the eastward extension of the trend of the San Bernardino Mountains to its intersection with the Colorado River just north of Blythe, Calif. As defined, the Basin and Range province lies north and east of the Mojave province, while the Salton Trough–Colorado Desert province lies to the south.

TABLE 1. Precipitation Data for Twentynine Palms, California.

Period	Mean monthly precipitation, in.	1981 recorded precipitation, in.
January	0.43	0.84
February	0.19	0.12
March	0.25	1.12
April	0.12	0.00
May	0.05	0.46
June	0.02	0.00
July	0.52	0.23
August	0.69	0.00
September	0.33	0.10
October	0.46	0.00
November	0.31	0.05
December	0.42	0.00
Annual	3.79	2.92

Dibblee (1980) discusses the regional structure of the Mojave Desert province; his discussion is paraphrased as follows: The Mojave Desert has a basement complex composed of Precambrian gneissic and plutonic rocks overlain by a Paleozoic and Mesozoic marine sedimentary series. During several Mesozoic orogenies, the sedimentary series was folded during the formation of low-angle thrust faults and high-angle faults. In the central and western Mojave Desert, the deformed sediments are locally intruded and overlain by Mesozoic plutonic rocks. The plutonic intrusions form the southeastern extension of the Sierra Nevada batholith.

During the Cenozoic era these basement rocks reacted to tectonic stresses and the Mojave Desert province became outlined as a wedge-shaped block between the San Andreas and Garlock Faults. Dibblee believes that during the early Tertiary period much of the basement complex was mountainous. By middle Tertiary (Oligocene-Miocene) the terrain had been affected by crustal movements and volcanic eruptions with part of the basement forming highlands while other parts were depressed to form undrained valleys. The valleys formed as trough-like basins with axes predominantly trending east-west. As the highlands rose, eroded basement rock and volcanic material that had erupted mainly from the valley margins accumulated in the subsiding valleys. This accumulation gave some valley basins great thicknesses of Oligocene to Pliocene volcanic-sedimentary sequences.

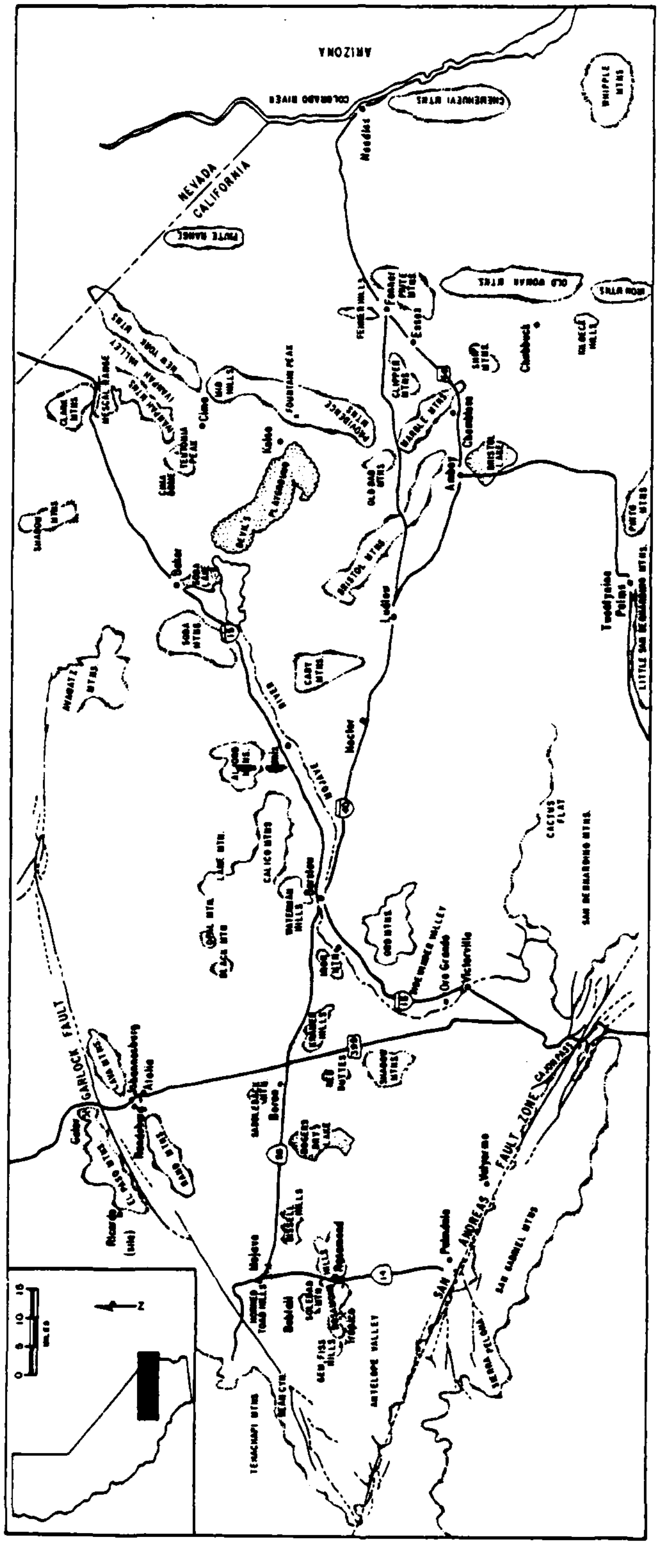


FIGURE 3. Mojave Desert Province. Modified from DeCourten (1979).

The volcanic-sedimentary sequences are deformed in all basins by Pleistocene crustal movements but are most severely deformed along and near the San Andreas fault zone. Locally, the sequences are deformed along the Garlock Fault and northwest-trending faults within the Mojave block.

Dibblee (1980) points out that the fault pattern within the Mojave block indicates that there are two sets of high-angle strike-slip faults as previously recognized by Hill and Dibblee (1953) and Garfunkel (1974). The dominant set is the longitudinal set of northwest trending faults of the San Andreas fault system (Figure 4). These faults are found mainly in the southeastern half of the Mojave Desert block and show small right-slip displacements. Major named northwest-trending faults include the Emerson (Dibblee, 1967a), the Ludlow (Dibblee, 1967b), the Bullion (Kupfer and Bassett, 1962), the Calico (Dibblee and Bassett, 1966; Dibblee, 1967a), Mesquite Lake (Dibblee, 1968a), Hidalgo (Surprise Springs) (Dibblee, 1967a) and the Pisgah Fault (Dibblee, 1966). The subordinate set is the transverse set of east-to-northeast trending left-slip faults such as the Garlock, Pinto Mountain, and Coyote Lake–Cady Faults. Some of the transverse faults intersect the longitudinal faults but do not cross them. Dibblee has noted that where they intersect, the terrain at the obtuse angle made by the intersection has been elevated into mountains by compression that probably resulted from the blockage of strike-slip movement on both faults. The terrain at the acute angle of each intersection is commonly depressed probably by the pull-apart tension such as the intersection of the San Andreas and the Garlock Faults.

Vertical displacements are continuing along many of the faults as indicated by radiometrically dated Pleistocene basaltic flows that have been vertically displaced as much as several hundred feet (Norris and Webb, 1976). Modern scarps have been formed in thick alluvial deposits that are cut by some of the internal faults. An example is a 1975 earthquake that ruptured and displaced the surface between the Calico and Emerson faults.

GEOLOGY

The geology of the Twentynine Palms Marine Corps Air Ground Combat Center is complex. The Center contains several mountain ranges consisting of interbedded Tertiary and Holocene volcanics and clastic sediments resting on a Mesozoic metamorphic-intrusive complex. The ranges are isolated by alluvium-filled valleys. Since the volcanics have not been isotopically dated, diagnostic correlation of rock units across valleys is not practical, making regional description of these rock units almost impossible. Therefore, to present as clear a picture as possible of the geologic setting of MCAGCC, the geology of individual ranges and selected features are described.

This section is a summary of data taken from Bassett and Kupfer (1964), Dibblee (1966, 1967a, 1967b, 1967c, 1968), and Wise (1969).

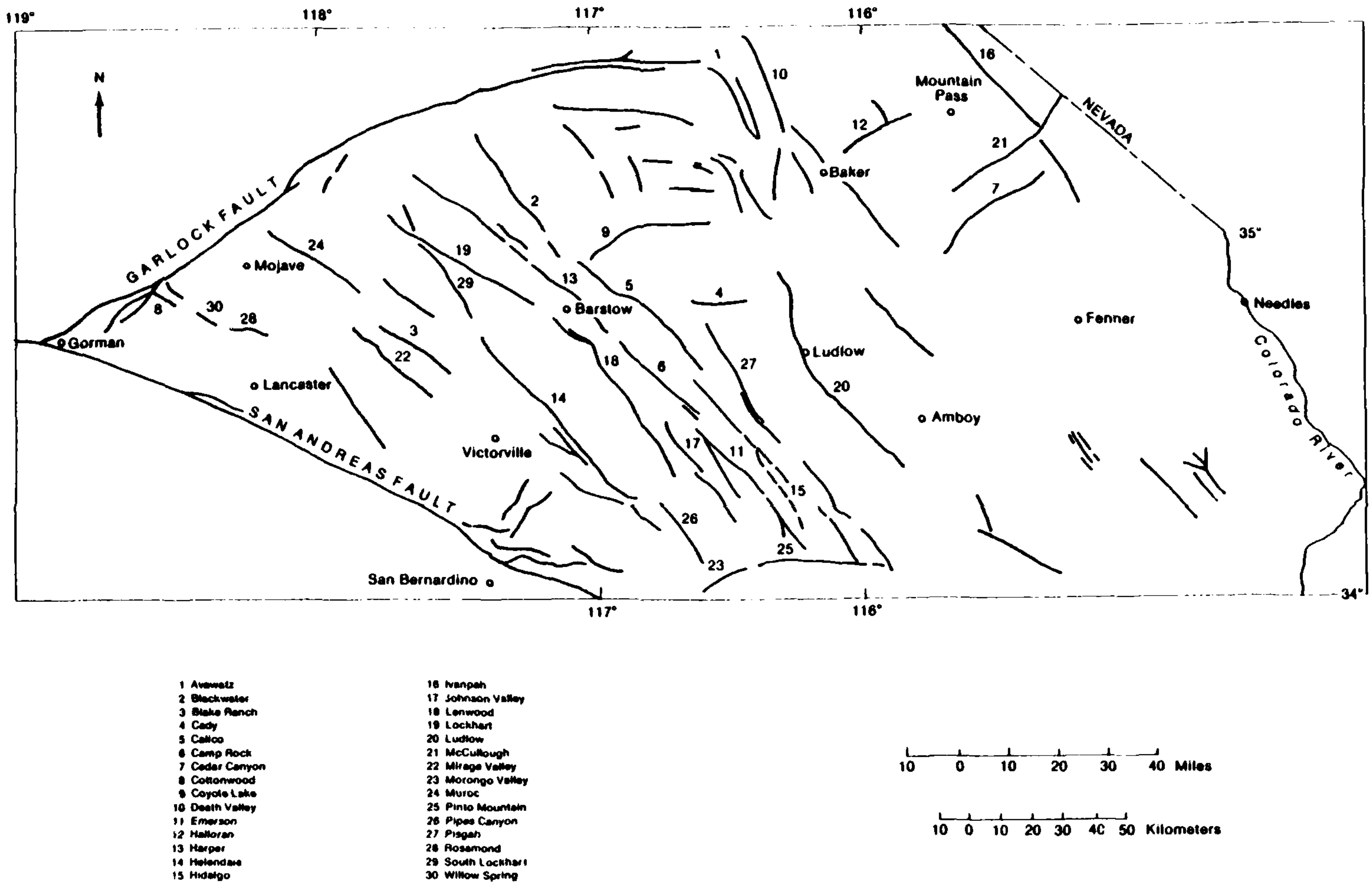


FIGURE 4. Some Known and Inferred Cenozoic Faults of the Mojave Desert. Modified from Norris and Webb, 1976.

THE WEST BULLION MOUNTAINS

The West Bullion Mountains are the main topographic feature within MCAGCC, Twentynine Palms, cutting the base roughly in half from north to south. The mountains are composed of Tertiary basalts, andesite breccias, tuff breccias, latite felsite, and fanglomerates with andesite detritus, intruded by Tertiary andesite to dacitic rocks. The western edge of the range is a northwest-trending boundary fault. Two other persistent northwest-trending faults cut the range. The flows and sediments generally strike northwest with low dips to the east.

The southern West Bullion Mountains consist of pre-Tertiary rocks. The dominant lithology is biotite quartz monzonite, although quartz monzonite and hornblende diorite (or gabbro) are also present. In some places, swarms of northwest-trending andesitic dikes intrude the biotite quartz monzonite (Dibblee, 1967c). At the very south end of the West Bullion Mountains, a few north-trending felsites (composed of sodic plagioclase, K-feldspar, quartz, and a trace of biotite) intrude the biotite quartz monzonite.

Sediments in the southern West Bullion Mountains area, including Deadman Lake and the Surprise Spring area (immediately west and north of the Administration Area for MCAGCC), are generally Quaternary in age and consist of alluvium deposits (Dibblee, 1967c, 1968). Windblown sand and alluvial fan gravels cover some of the older alluviums in certain locations.

PISGAH CRATER

The lavas of Pisgah Crater, located northwest of Lavic Lake, flowed onto alluvium and onto clays of the northern part of Lavic Lake. Wise (1969) notes five flows in the complex, all of which are vesicular, black, fresh basalt porphyries with olivine phenocrysts. Individual flows may be about 50 feet thick around Pisgah Crater but taper out to a few feet thick at the flow's margin. Pisgah Crater is formed of fragments and lapilli of brownish-black scoriaceous basaltic glass. The basalt of Pisgah Crater is presumably very late Pleistocene or Recent (Dibblee, 1966b).

SUNSHINE PEAK LAVA FLOW AND CRATERS

Basaltic lava erupted from at least three small craters west of Lavic Lake. The basalt is vesicular, hard, and black with olivine phenocrysts. The craters consist of brownish-black scoriaceous basalt that is probably Pleistocene in age (Dibblee, 1966b).

SUNSHINE PEAK

The dominant rock of Sunshine Peak is dacite porphyry, a gray-white to light greenish-gray rock, with 40 to 60% phenocrysts that are mostly plagioclase, but include some biotite, hornblende and quartz. According to Dibblee (1966b), the intrusive mass may have been emplaced as emerging dikes, and are probably Oligocene or early Miocene, possibly older. The dacite prophyry is intruded by swarms of northwest-trending andesite porphyry dikes.

Roof pendants of biotite quartz monzonite and quartz monzonite occur in the dacite porphyry. The biotite quartz monzonite is a massive medium-grained granitoid rock composed of 10 to 30% K-feldspar, 3 to 20% biotite, 0 to 5% hornblende, and accessory sphene, zircon, and magnetite. The biotite quartz monzonite is Mesozoic.

The quartz monzonite is a gray-white, massive, medium-grained granitoid rock composed of quartz, K-feldspar, and sodic plagioclase in about equal portions; 2 to 5% biotite; and accessory sphene, zircon, and magnetite. The quartz monzonite roof pendants are dikelike and trend northwest. Based on relations elsewhere, the quartz monzonite is Mesozoic.

LAVA BED MOUNTAINS

Older valley sediments in the Lava Bed Mountains, which are west of Lavic Lake, are also presumably present under the surficial sediments in the valleys. These sediments are mostly coarse detrital materials up to 2000 feet thick, Pleistocene in age, possibly in part very late Tertiary. The sediments consist of unstratified fanglomerates, cobble-pebble gravel, and bedded gravelly sand and silt, and locally contain an interbedded tuff. The sediments have a red conglomerate and boulder gravel conglomerate as a basal unit (Dibblee, 1966b).

The basalt of the Lava Bed Mountains is black, massive, slightly to moderately vesicular rock with a few olivine phenocrysts. The lava flows are as thick as 200 feet, and are unconformably (?) overlain by the Pleistocene fanglomerate and gravel units that are probably late Tertiary or early Quaternary in age (Dibblee 1966).

The basalt overlies Tertiary varicolored andesite porphyry with 20 to 50% phenocrysts that are mostly plagioclase, but with some biotite and basaltic hornblende. The basalt also overlies Tertiary varicolored tuff breccia that contains small fragments of devitrified pumice, and small to large fragments of Tertiary andesite and andesite porphyry in a matrix of fine- to coarse-grained tuff.

The rocks described above are intruded by Tertiary varicolored andesite porphyry with 20 to 50% phenocrysts that are mostly plagioclase, but with some biotite, rare quartz, and rare basaltic hornblende.

AMBOY CRATER

Amboy Crater is located just east of a jog in the northeastern boundary of the Center (Figure 2). Bassett and Kupfer (1964) state

> "A very prominent undissected cinder cone, known as the Amboy Crater, is located just southwest of the town of Amboy and southeast of the town of Bagdad . . . The cone, which is breached on the western side, rises about 200 feet above its associated flows that spread out over an area of nearly 40 square miles. The volcano erupted along the northern border of Bristol Dry Lake and poured lava out onto its surface dividing it into the two present playas, Alkali and Bristol Dry Lakes."

ROCKS IN THE VICINITY OF EMERSON (DRY) LAKE

The rocks in the vicinity of Emerson (Dry) Lake, on the west-central boundary of the Center, are Precambrian (?) gneisses and marble, intruded by Mesozoic rocks.

A granite gneiss and an aplitic gneiss are in the area. The granite gneiss is composed of medium- to coarse-grained quartz, K-feldspar, and plagioclase in about equal amounts with some biotite and rare hornblende. The granite gneiss is segregated into light and dark streaks. The aplitic gneiss consists of fine-grained quartz, K-feldspar, and sodic plagioclase with less than 2% biotite as minute flakes.

The gneisses are intruded by quartz monzonite that contains roof pendants of hornblende diorite and biotite diorite. Off the military reservation the quartz monzonite is cut by northwest-trending mafic (dioritic to andesitic) dikes. Some quartz-latite dikes cut the quartz monzonite just west of the Center's boundary. The quartz monzonite gave a lead-alpha age of approximately 89 million years (Dibblee, 1967a).

The roof pendants have a granitoid texture and are medium- to coarse-grained rock. The hornblende diorite is dark-gray to black, composed mostly of calcic plagioclase and hornblende with some biotite and minor amounts of iron oxides, chlorite, and epidote.

The biotite diorite is dark gray and is composed of calcic plagioclase and biotite with small amounts of hornblende, chlorite, and iron oxides.

REGIONAL GEOPHYSICAL STUDIES–AEROMAGNETICS

Aeromagnetics were flown over the western two-thirds of MCAGCC on 24, 25, and 26 September 1982. The survey was flown by Aerial Surveys, Ltd. for Meiiji Resource Consultants, Salt Lake City, Utah, who were under contract with the Navy to perform the service. The survey was flown in a north-south direction with a flight line spacing of approximately 1 mile and a mean terrain clearance of 1000 feet, and covered more than 1600 square miles. The resultant aeromagnetic map (Plate 1) was contoured at 20 gammas locally and 100 gammas overall. Plate 1 is contained in the rear pocket of this report; the base boundary shown is approximate.

The aeromagnetic map contains a tremendous amount of information that would require a report in itself to fully discuss. Therefore, only obvious features (or the lack thereof) and features pertaining to geothermal studies will be discussed below.

The map displays two prominent magnetic lows: the largest is located directly south of Lavic Lake in the northwestern corner of the Center, and the other is located just east of Deadman Lake. The low near Deadman Lake is associated with an elongated structural feature of nearly uniform width trending approximately N40°W. This feature is interpreted to be a large, somewhat narrow, sediment-filled valley (a graben) such as those found in the Basin and Range province of Nevada and Utah. The magnetic low south of Lavic Lake is more rounded in appearance, but tends to be slightly elongated in a east-west direction and

appears to correspond to a structure that also trends east-west. While it could be the magnetic signature of a deep, sedimentary-filled basin, the anomaly could also be caused by a collapsed volcanic feature or vent.

The N40°W and east-west structural trends, which appear to define the magnetic lows just discussed, intersect in the northwestern part of the Center near Pisgah Crater and Sunshine Peak. Because they parallel the strikes of the San Andreas and Pinto Mountain Faults, these two structural trends are considered to be more regional than localized features. Although any recent geologic activity or movements along these features is not known, the features probably have caused a large weak zone in the crust where they intersect and could be partly responsible for the existence of the Pisgah Crater/Sunshine Peak volcanic field.

Prominent magnetic highs on the map are located just outside of the western-central boundary of the Center. These highs correspond to the dioritic rocks as mapped by Dibblee (1967a) just southwest of Emerson Lake. One other localized magnetic high is located immediately north of the administration area in the West Bullion Mountains. This anomaly is likely attributable to a highly magnetic body located either at ground surface or buried just beneath the surface.

It is interesting to note that neither the older basalts of the West Bullion Mountains nor the younger basaits of the Pisgah Crater area correspond to any magnetic highs. Since magnetite is an accessory to almost all basalts, it is curious that areas with large basaltic flows did not provide magnetic "spikes," especially when these basalts are in close proximity to sedimentary-filled basins and grabens. Pyritization of the magnetite seems unlikely as a cause, particularly in the recent basalts of Pisgah Crater.

Another point of interest on the aeromagnetic map occurs near the southern boundary line west of the Main Camp/Administration Area. In this area a marked change occurs in the direction of the magnetic contours from approximately N40°W to nearly N60°W or greater. This change, in varying degrees, can be seen in the entire southwestern portion of the map. One obvious explanation is that the Pinto Mountain Fault is a right-lateral fault as opposed to left-lateral as previously thought (see Dibblee, 1968). As the Pinto Mountain Fault moves right-laterally, it bends the shallow crust north of the fault to the east, creating drag features and deflecting the regional N40°W trend to nearly N60°W. If this is the case (the theory has not been field-tested), the low magnetic anomaly just west and southwest of the Main Camp/Administration Area, underneath Mesquite Lake, may be the result of east-west tension causing a pull-apart tear in the crust. Such a feature could, in part, explain the existence of the geothermal resource in this area.

TWENTYNINE PALMS AREA

HYDROLOGY

No perennial streams exist in the Twentynine Palms area; however, flash flooding can occur in washes during and after thunderstorms. The average rainfall in the area is about 4 inches, and the yearly average temperature is about 67°F (Freckleton, 1982). Most of the rainfall comes as summer thunderstorms. Groundwater originates from precipitation runoff

in the mountains. The runoff infiltrates the unconsolidated deposits, and water that is not intercepted and used by native vegetation or evaporated from the soil finds its way to the water table. Infrequently, a small quantity of recharge occurs directly as deep penetration of rain. Some recharge occurs by subsurface flow from adjacent basins.

Movement of groundwater through the valleys is impeded locally by groundwater barriers, which the U.S. Geological Survey usually assumes to be faults (Freckleton, 1982). However, other structures can act as barriers, such as buried flows, silt-filled giant desiccation cracks, or a rise in bedrock topography.

Some of the more important hydrological studies in the Twentynine Palms vicinity are Thompson (1929, Mojave Desert region), Freckleton (1982, Twentynine Palms Indian Reservation), Moyle (1967, Lavic Valley), Bader and Moyle (1960, Yucca Valley-Twentynine Palms–Mesquite basin), and Schaefer (1978, Surprise Spring subbasin).

Thompson (1929) noted that in 1917 he had seen a large reentrant in the mountains south of the existing town of Twentynine Palms, which was occupied by an alluvial slope 5 to 6 miles long and 3 to 4 miles wide. At the foot of this reentrant stood the Twentynine Palms springs. Thompson believed that the water that percolated down this slope encountered a water barrier at the Pinto Mountain Fault and rose to the surface.

Freckleton, in his 1982 study of the Twentynine Palms Indian Reservation, notes that the Pinto Mountain Fault acts as a groundwater barrier because water levels on the south side of the fault are higher than those on the north side. He also notes that the Mesquite Lake Fault, another groundwater barrier, crosses the Reservation and that Dibblee (1968) maps a probable fault that could be a groundwater barrier crossing the Reservation in a roughly east-west trend.

In the Twentynine Palms–Yucca Valley area, water levels in wells range from near land surface to more than 500 feet below land surface (Bader and Moyle, 1960). Near Mesquite Lake, north of the town of Twentynine Palms, and at the Oasis of Mora, just south of Twentynine Palms, a few wells flow continuously or intermittently. Barriers separate the main valley areas into smaller groundwater basins. The displacement of water level across the barriers is locally as great as 240 feet. In this area, recharge is mainly by infiltration of runoff from the eastern slope of the San Bernardino Mountains and northern slopes of the little San Bernardino Mountains.

The water supply at the Marine Corps Air Ground Combat Center is from wells in the Surprise Spring subbasin, which, together with the Deadman Lake subbasin, forms the Deadman Valley subbasin.

Schaefer (1978) describes the basin and subbasin boundaries as faults and consolidated rocks (Figure 5). The boundaries for Surprise Spring subbasin are the Emerson and Copper Mountain Faults to the west and the Surprise Spring Fault and consolidated rocks to the east. Adjoining Surprise Spring subbasin to the east is Deadman Lake subbasin, whose boundaries are the Mesquite Lake Fault and Deadman Lake to the east and a transverse arch to the south. The boundaries of Mesquite Lake subbasin, which is to the south of the transverse arch, are the Copper Mountain and Pinto Mountain Faults to the southwest and the Mesquite Lake Fault to the east.

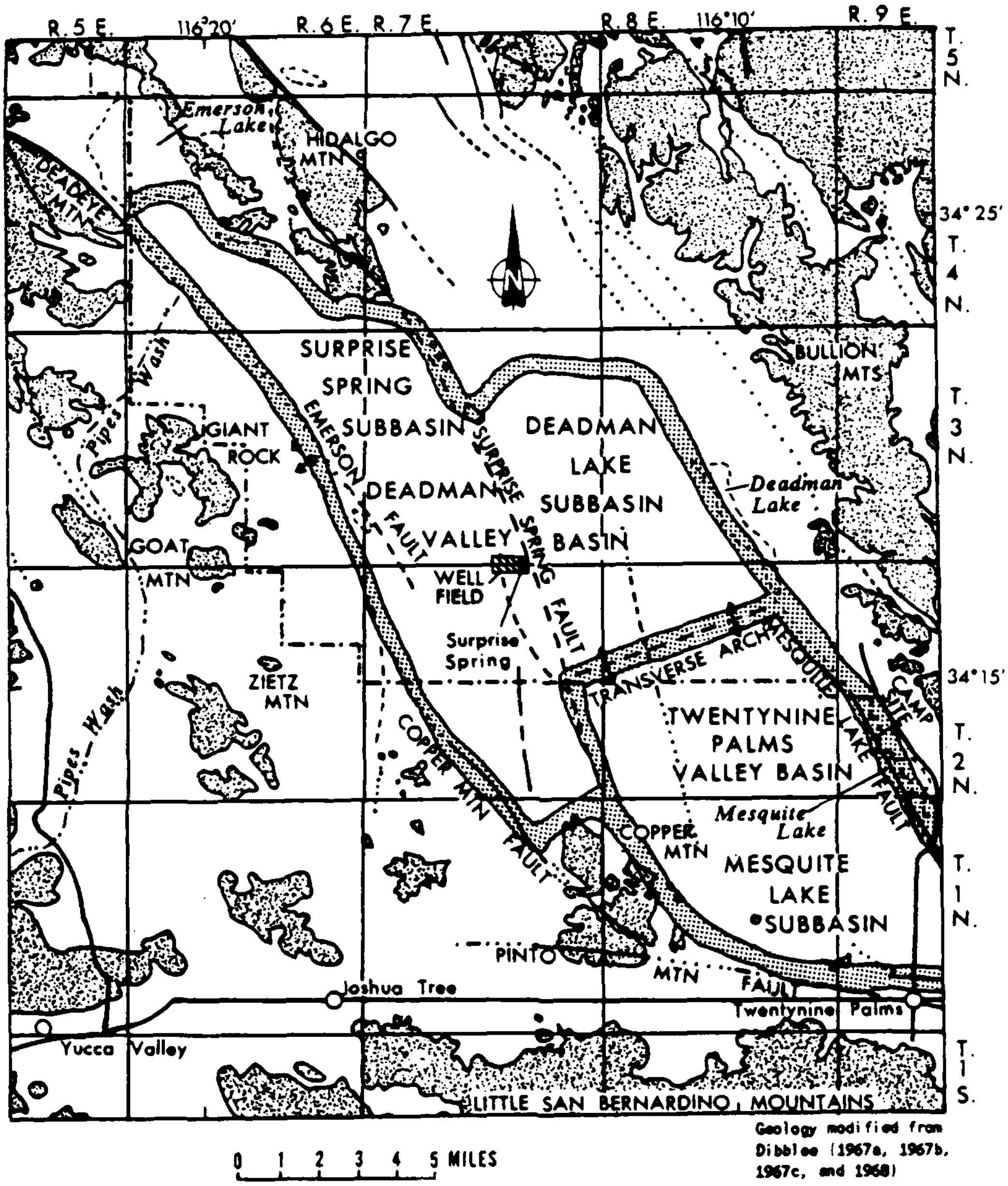


FIGURE 5. Location of Area, Geology, Basins, and Subbasins Studied Near Twentynine Palms. Modified from Schaefer, 1978.

Schaefer's description of the movement of water between subbasins is paraphrased in the following paragraphs.

Water-level measurements from the three subbasins give an indication of the general direction of the flow of groundwater (Figure 6). At the north end of the Surprise Spring subbasin, the water-level differential between the wells on the east and west sides of Emerson Fault is about 50 feet, the level in the wells on the east being lower. East of Emerson Fault some groundwater moves toward Emerson Lake; however, most of the groundwater moves southeastward toward Surprise Spring.

A difference in water-surface altitude of about 200 feet exists between the Surprise Spring and Deadman Lake subbasins.

Schaefer also states the following:

> "In Deadman Lake subbasin the water moves generally eastward toward Deadman Lake. Previous (mid-1960s) measurements of water level in wells that are now destroyed indicated a southward component of flow from the Deadman Lake area across the transverse arch into Mesquite Lake subbasin. This situation probably has not changed. In addition to ground water moving into the Mesquite Lake area from the north, a small quantity of ground water moves northeastward into Mesquite Lake subbasin from the Joshua Tree and Yucca Valley areas (Lewis, 1972). Ultimately some ground water discharges at Mesquite Lake, and some continues to move eastward across Mesquite Lake fault. . . ."

Presuming an aquifer thickness of 200 feet–determined by test drilling, seismic refraction work, and economic considerations–and a specific yield of 13%, confirmed by the test drilling and logs of other wells, the Surprise Spring subbasin contained about 650,000 acre-feet of water (Schaefer, 1975). Usage at that time was 2600 acre-feet annually. Most of the wells in Surprise Spring subbasin produce water of good quality.

Because of limited pumping in the Deadman Lake and Mesquite Lake subbasins the water levels have not declined significantly. Schaefer (1975) gives a figure of 290,000 acre-feet in Deadman Lake subbasin.

WELL TEMPERATURES

Warm or hot springs and wells give the most direct indication of the presence of a geothermal resource. Figure 7 contains contoured data on the temperatures of wells in the vicinity of Twentynine Palms. (The analyses discussed in the Water Geochemistry section of this report provided the data presented in this section.) Contouring is not totally controlled as wells are not necessarily located at critical sites. No determination could be made as to whether or not all the wells used in contouring were in the same aquifer. No determination of the depth of production was made, although within a single aquifer temperatures can increase with depth. Despite the limitations resulting from this ambiguity of information, the writers believe that the general contour pattern of temperatures is thought to be representative of the area.

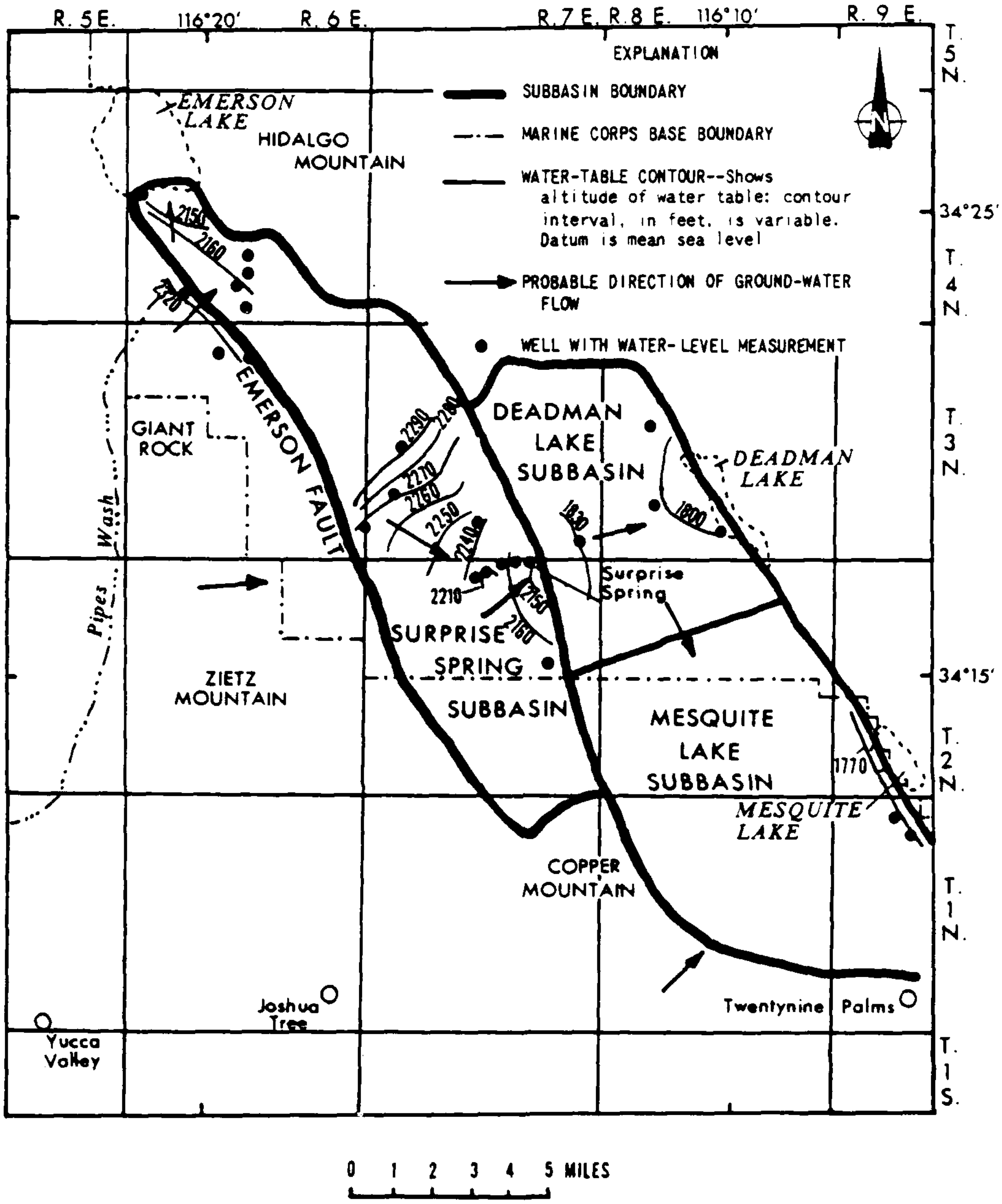


FIGURE 6. Water-Table Contours, Autumn 1975. Modified from Schaefer, 1978.

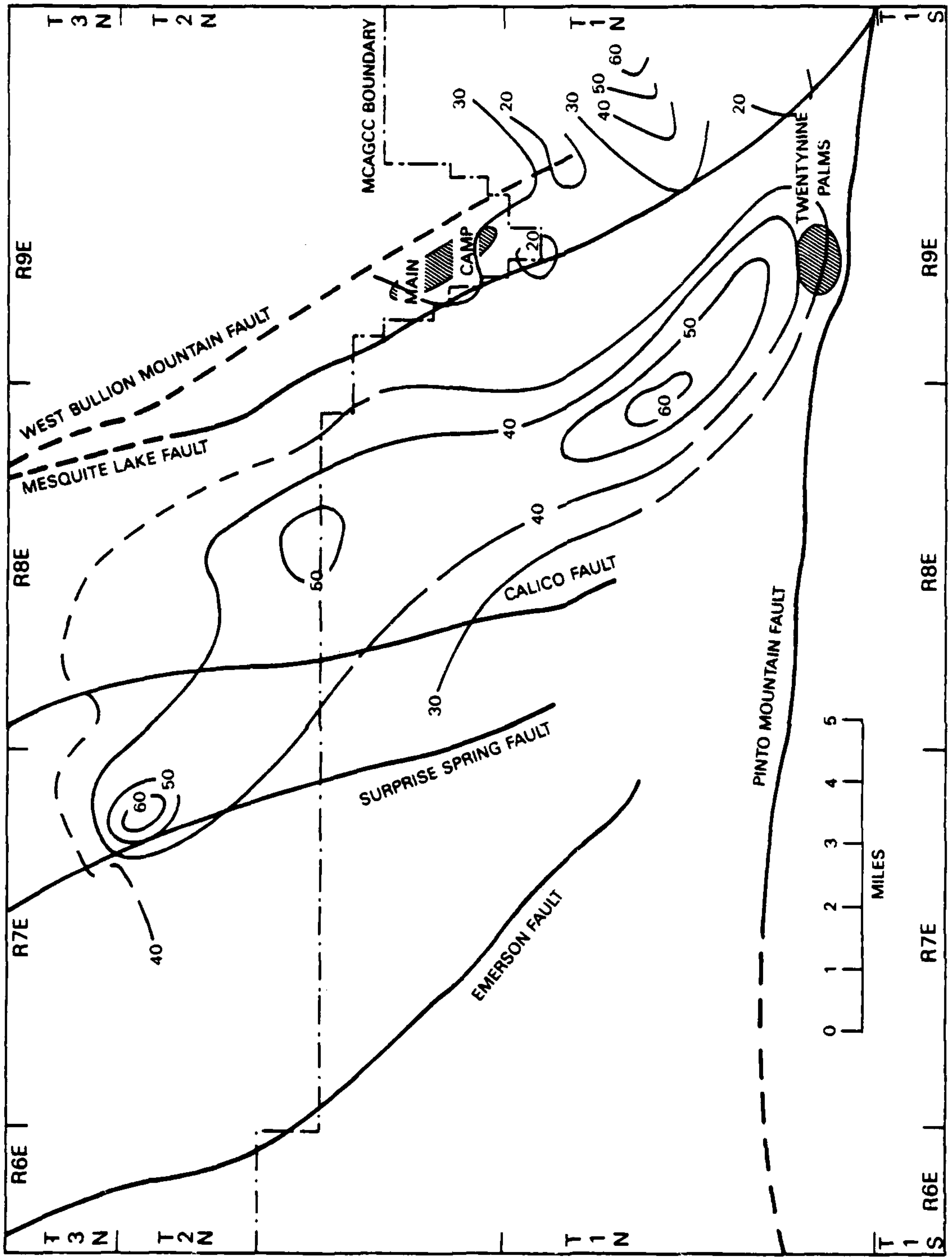


FIGURE 7. Maximum Measured Temperatures in Wells Around Twentynine Palms. Contour values in °C.

The most impressive anomaly is the northwest-trending high in townships T.1N., R.8E.; T.1N., R.9E.; T.2N., R.7E.; and T.2N., R.8E. (Appendix A provides information about the numbering system used to designate townships.) This linear anomaly has several localized highs within it. Its strike is more westerly than the northwest-trending Calico and Surprise Spring Faults, but this westerly strike may be apparent rather than actual. Although plotted as one anomaly, the strike might actually be two anomalies with the northernmost high being associated with Surprise Spring Fault. If that were the case, the temperature high (63°C) in the northeastern portion of T.1N., R.9E. would be just east of the West Bullion Mountain/Mesquite Lake fault zone, the linear anomaly with the 67°C and 52°C highs would be just east of the Calico Fault, and the northernmost anomaly (67°C) would be just east of the Surprise Spring Fault.

GEOTHERMOMETERS

Water analysis may frequently be used to estimate reservoir temperatures by use of geothermometry. The two main families of chemical geothermometers are the silica geothermometers and the alkali geothermometers. Sometimes both types give concordant results, but frequently, results calculated with different geothermometers give discordant results.

Silica Geothermometers

Several silica chemical geothermometers are available: quartz-no-steam-loss (also called quartz-conductive-cooling), quartz maximum steam loss, chalcedony, α-cristobalite, β-cristobalite, and amorphous silica (Fournier, 1981). All have the general formula

$$T = \frac{\text{(a number from 784 to 1309)}}{\text{(a number from 4.51 to 5.75)} - \log C} - 273.15$$

where

T = the reservoir temperature (°C)
C = the concentration of SiO_2 in parts per million (or milligrams per liter)

The two quartz and chalcedony geothermometers were calculated from available water analyses. The amorphous silica geothermometer often gives unsatisfactory results and in this study gave numerous temperatures below freezing. These results are therefore not reported. Results for the quartz-conductive-cooling, quartz-maximum-steam-loss, and chalcedony geothermometers are given in Appendix A.

Excluding mistakes in analysis, all sample collection errors tend to lower calculated results, for example, precipitation of silica after sample collection and dilution of geothermal waters by cold, low-silica waters. Hence, silica geothermometers represent minimum temperatures. The silica geothermometers generally apply to the temperature range 0 to 250°C (Fournier, 1981). Since all silica geothermometers have the same type formula, the general form of contoured results should be the same. Therefore, only the quartz-conductive-cooling thermometer was contoured (Figure 8).

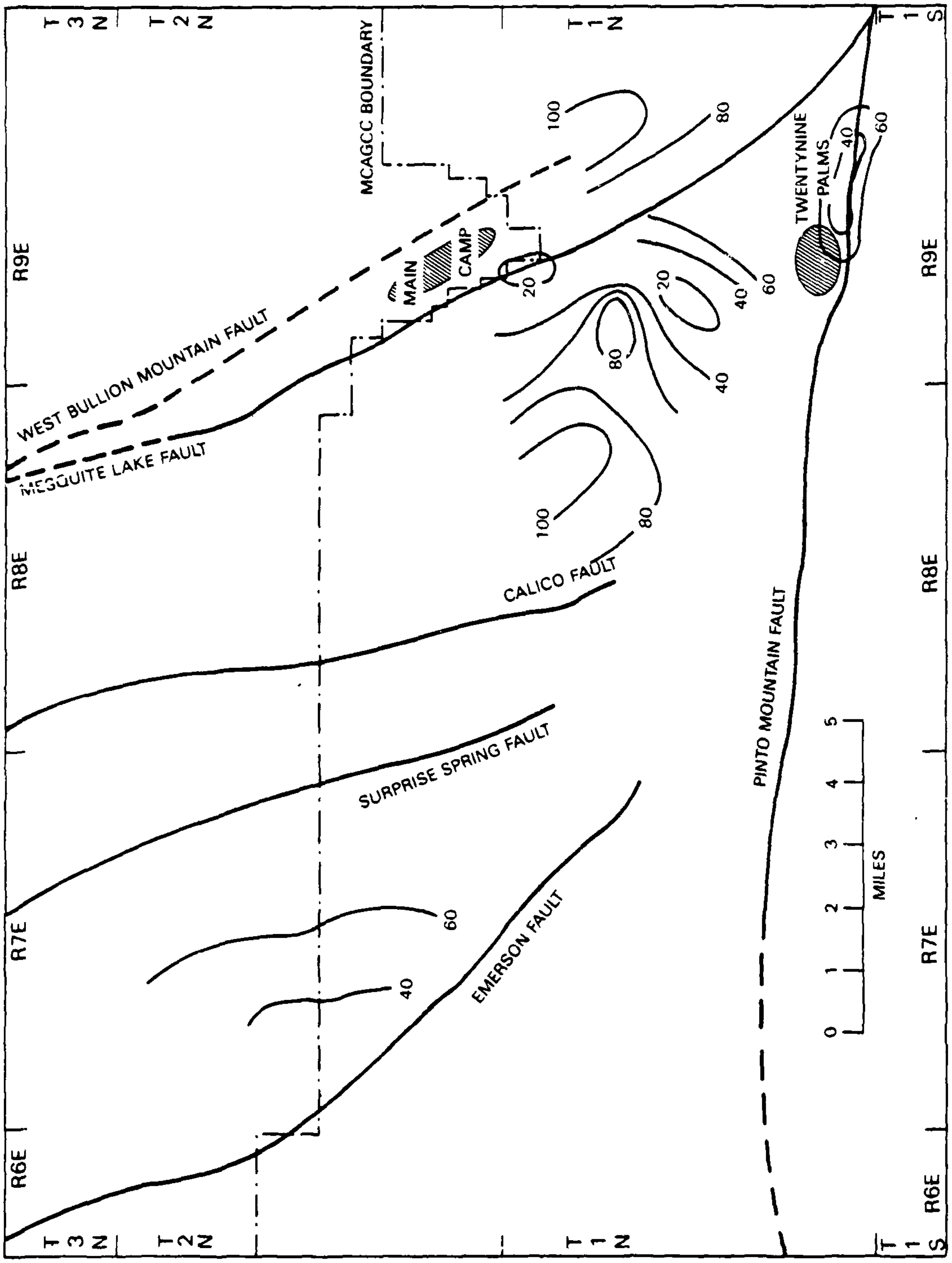


FIGURE 8. Quartz-Conductive-Cooling Geothermometer Results. Contour values in °C.

URS Corporation (1985) discusses the problem of choosing between the quartz-conductive-cooling geothermometer and the chalcedony geothermometer in the Twentynine Palms region. They chose to use the chalcedony geothermometer because it gave results with the closest agreement to measured temperatures. However, the writers of this report believe that because geothermometers were developed to estimate reservoir temperatures at depth, the quartz-conductive-cooling geothermometer is most appropriate. The chalcedony geothermometer results would be about half those of the quartz-conductive-cooling geothermometer.

The southern portion of the large northwestern-trending thermal anomaly outlined by the maximum recorded temperatures (Figure 7) is clearly indicated by the quartz-conductive-cooling geothermometer results (Figure 8). The highest measured water temperature was 67°C. The quartz-conductive-cooling geothermometer indicates a reservoir temperature of 117°C, and the chalcedony geothermometer shows 76°C. The high measured temperatures in the eastern half of T.1N, R.9E. are also reflected on the plot of the quartz-conductive-cooling geothermometer (Figure 8).

Mixing models were developed in the 1970s for silica geothermometers to compute how much geothermal groundwater and normal groundwater a sample contains; the models also allow calculation of the undiluted reservoir temperature (Fournier and Truesdell, 1974; Truesdell and Fournier, 1977). Unfortunately, the proper combination of hot and cold springs are not available in the Twentynine Palms area to utilize the model. This circumstance also precludes using chloride-enthalpy mixing models.

Alkali Geothermometers

Two commonly used sodium-potassium (Na-K) geothermometers are that of Truesdell (1976) and that of Fournier (1979). The latter is generally known as the Na-K chemical geothermometer, modified. Where waters come from high-temperature environments (>180 to 220°C) the Na-K geothermometer generally gives excellent results. The main advantage of the Na-K geothermometer is that it is less affected by dilution and steam separation than other commonly used geothermometers, provided that there are few positive ions of sodium or potassium ($Na+$ or $K+$) in the diluting waters relative to the reservoir water. It appears, however, that the Na-K method generally fails to give reliable results for waters from environments below 100°C. In particular, low-temperature waters rich in calcium give anomalous results by the Na-K method (Fournier, 1981).

The Na-K modified calculated reservoir temperatures are given in Appendix A. Temperatures calculated with the Na-K geothermometers are generally higher than those taken with silica geothermometers or sodium-potassium-calcium geothermometers.

The sodium-potassium-calcium (Na-K-Ca) geothermometer of Fournier and Truesdell (1973) was developed specifically to deal with calcium-rich waters that give anomalously high calculated temperatures by the Na-K method (Fournier, 1981). The effect of dilution on the Na-K-Ca geothermometer is generally negligible if the high-temperature geothermal water is much more saline than the diluting water and the geothermal water contains more than 20 to 30% geothermal brine. Calculated Na-K-Ca geothermometer temperatures are given in Appendix A and plotted on Figure 9.

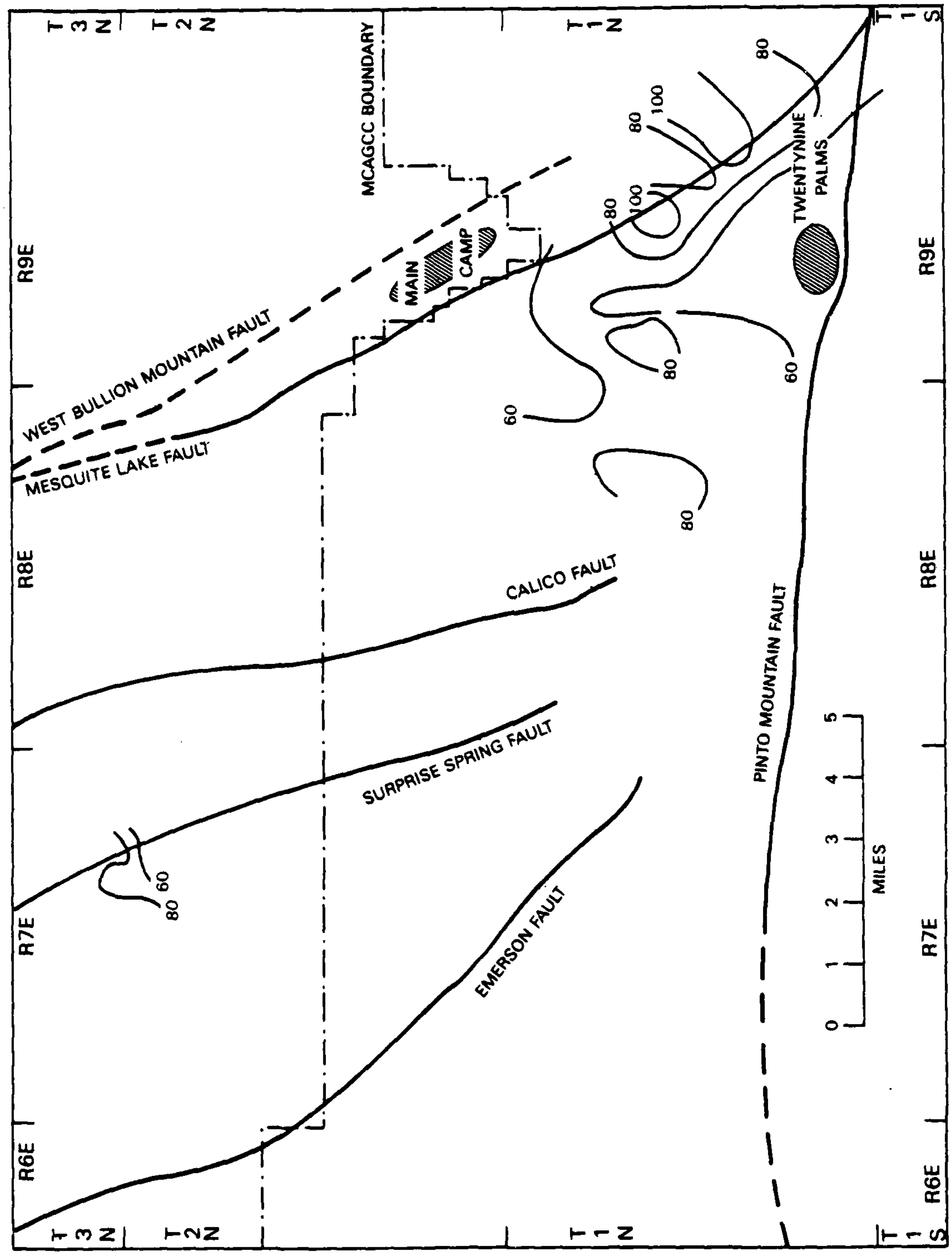


FIGURE 9. Sodium-Potassium-Calcium (Na-K-Ca) Geothermometer Results. Contour values in °C.

Fournier and Potter (1979) showed that the Na-K-Ca geothermometer gives anomalously high results when applied to waters rich in the magnesium ion. To address this problem they devised a magnesium correction, which was applied where appropriate. Predicted reservoir temperatures corrected for magnesium appear to be low. For instance, a magnesium-corrected Na-K-Ca geothermometer whose correction was calculated from a chemical analysis of water taken from well 1N/9E-33J2 gives a temperature of 21°C, while the measured temperature was 23°C (Freckleton, 1982).

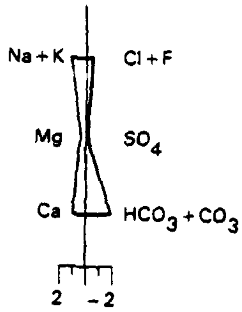
The Na-K-Ca geothermometer indicates a moderate-temperature (maximum temperature 88°C) anomaly over the southern portion of the large northwestern-trending thermal anomaly as outlined by maximum recorded well temperatures (Figure 7). The area of high measured temperatures in the eastern half of T.1N., R.9E. has predicted Na-K-Ca reservoir temperatures of up to 145°C.

Although the various geothermometers show some general similarities in pattern, and the patterns show relationships to known structures as determined by geology and geophysics, the writers are reluctant to use the geothermometers as quantitative measures. The silica geothermometers give only minimum reservoir temperatures. Calcium affects the sodium-potassium geothermometer. If the sodium-potassium-calcium geothermometers are correct, only low- to moderate-temperature resources are present. One factor not yet evaluated is that the alkali-metals and alkaline-metals–alkaline-earth geothermometers are based on sodium-chloride brines. The dominant brine type in the area of warm waters around Twentynine Palms is sodium sulfate. The effect of this brine on predicted geothermal reservoir temperatures is unknown.

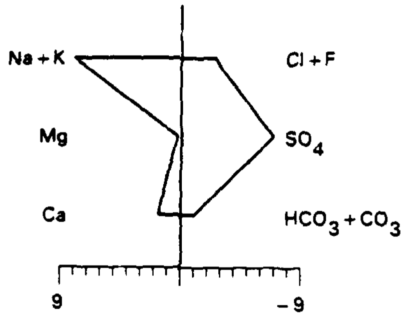
WATER GEOCHEMISTRY

Overall water geochemistry was reviewed to see if areas of possible mixing between shallow and deep (geothermal) waters could be located. Chemical analyses of waters in the Twentynine Palms area were obtained from Bader and Moyle (1960), Moyle (1967), Combs (1973), Schaefer (1978), and Freckleton (1982). To compare waters, computer-plotted modified Stiff diagrams were used (Figure 10). The Stiff diagram is a plot of elecrical milliequivalents of the major cations–sodium plus potassium, magnesium, and calcium; and the anions–chloride plus fluoride, sulfate, and bicarbonate plus carbonate. The shape of the Stiff diagram allows visual comparison of water analyses. Modified Stiff diagrams allow determination of the general quality of the analyses. If the area on the cation (right-hand) side of the diagram is approximately equal to the area on the anion (left-hand) side, the analysis is probably good; if not, it is definitely poor and the analysis should not be used to calculate chemical geothermometers or to make other hydrological interpretations.

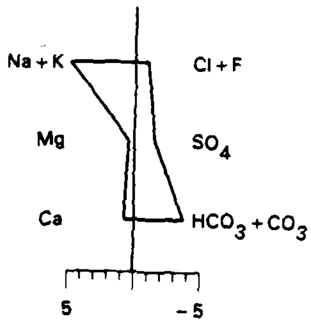
The most common alluvial groundwaters are sodium-bicarbonate waters ($Na > Ca \geq Mg$; $HCO_3 + CO_3 > Cl + F \geq SO_4$. Comparisons between constituents are made in electrical milliequivalents). These waters are typically low total dissolved solids at a few hundred milligrams per liter, and are found in the east-west trending developed area along the Twentynine Palms highway (Highway 62) in the southern part of the studied area, north of the Pinto Mountain Fault.



(a) Well Site 1N/6E-29N1 (12-28-56).
Typical calcium-bicarbonate water.



(b) Well Site 1N/9E-7E1 (2-25-55).
Typical sodium-sulfate (chloride) water.



(c) Well Site 1N/9E-15N1 (5-5-54).
Typical sodium-bicarbonate water.

FIGURE 10. *Typical Stiff Diagrams Indicating Water Quality From the Twentynine Palms Area.*

The second most common groundwaters are the sodium-sulfate waters ($Na + K \gg Ca > Mg$; $SO_4 \gg Cl > HCO_3$). These waters, found north of the sodium-bicarbonate waters, are of poor quality and are generally higher in total dissolved solids with high concentrations of fluoride.

Two possible origins for the sodium-sulfate waters exist, of which the more probable is Mesquite Lake playa. Natural sodium-sulfate deposits are rare, but not unknown. For example, in climatic periods of low precipitation, when the Great Salt Lake in Utah has a high total-dissolved-solid content, the mineral mirabalite ($Na_2SO_4 \cdot 10H_2O$) precipitates out of the brines during the winter. Above 32.4°C, mirabalite dehydrates to thenardite, an anhydrous sodium sulfate (also known as Glauber's salt). Beneath the silts and clays that lie on the bottom of the Great Salt Lake is a thick section of alternating clay and thenardite layers deposited in a cooler Pleistocene (or Tertiary) climate (Eardley, 1962). Thus, it is quite possible that the sediments of Mesquite Lake could contain sodium sulfate deposited when the climate in the Twentynine Palms area was colder. Mesquite Lake could well be the source of the sodium sulfate in the groundwaters.

The other possible origin for the sodium-sulfate waters is the presence of a high-temperature geothermal system. Sodium-sulfate waters are frequently produced by the condensed steam in high-temperature geothermal systems. The data in hand do not give any indications of a high-temperature resource at depth in the Twentynine Palms area. Geothermal sodium-sulfate brines are usually, but not always, "acid sulfate" brines with low pH values. As an example, the Coso Hot Springs known geothermal resource area contains a boiling pot with a pH of 1.5; however, the pH of Mesquite Lake subbasin waters is between 7 and 8.

Waters from sample sites 1N/9E-16G1 and -17J1, which are sodium-sulfate carbonate waters ($Na \gg Ca = Mg$; $SO_4 = CO_3 > Cl$), probably represent a mixture of Twentynine Palms Valley basin and Mesquite Lake subbasin waters.

The third most common groundwaters are sodium-calcium-carbonate ($Na \geq Ca > Mg$; $HCO_3 = CO_3 > Cl + F \geq SO_4$) waters with low total dissolved solids. This type of water is generally found in the southwestern region of the study area.

The Deadman Lake subbasin described by Schaefer (1978) has complex groundwater chemistry. Schaefer notes that the waters of this subbasin are of poorer quality because of their higher total dissolved solids and fluoride than those of the southern part of the Surprise Spring subbasin. The following types are found in the Deadman Lake subbasin: (1) sodium-carbonate water, (2) sodium-sulfate water, (3) sodium-chloride-sulfate-carbonate water (sampling site 2N/8E-11B1; no Ca or Mg, $Cl + F = SO_4 = HCO_3 - CO_3$), (4) sodium-sulfate-chloride water (sampling site 2N/8E-29C1 and -34D1; $Na \gg Ca$, $Mg = 0$, $SO_4 > Cl + F \gg HCO_3 + CO_3$), and (5) sodium-chloride-sulfate water (sampling site 3N/8E-17L1; $Na \gg Ca$, $Mg = 0$, $Cl + F > SO_4 \gg HCO_3$). The sodium-carbonate brines in the west-central area of Deadman Lake subbasin (sampling sites 3N/7E-36G1 and -36K1) probably represent inflow from the southern portion of the Surprise Spring subbasin (Schaefer, 1978). Sampling sites are too sparse to allow speculation on the origins or significance of the other water types.

The southern Surprise Spring subbasin waters are of the sodium-carbonate type. The waters of northern Surprise Spring basin are complex chemically; the following types are

found: (1) sodium-calcium-chloride-sulfate-bicarbonate water (sampling sites 3N/7E-18D1 and 4N/6E-24M1; Na > Ca > Mg, Cl + F > SO_4 ≫ HCO_3 + CO_3), (2) calcium-sodium-chloride water (sampling site 4N/6E-34E1; Ca > Na > Mg, Cl + F > SO_4 ≫ HCO_3 + CO_3), (3) calcium-sodium-magnesium-sulfate water (sampling site 4N/6E-28R1; Ca > Na > Mg, Cl + F > SO_4 ≫ HCO_3 + CO_3), (4) sodium-bicarbonate-chloride water (sampling site 4N/6E-27D1; Na, Ca = 0 = Mg, HCO_3 + CO_3 > Cl, SO_4 = 0), and (5) a sodium-chloride-sulfate bicarbonate water.

Trace ions that are frequently important either as components or indicators of geothermal brines are boron, fluoride, arsenic, and lithium. No data on arsenic or lithium contents of waters near Twentynine Palms are available. Both boron and fluoride exhibit distinct highs in the vicinity of the warm waters in the eastern half of T.1N., R.9E.

SITE-SPECIFIC STUDIES: MAIN CAMP/ADMINISTRATION AREA

GRAVITY

Geophysical field studies at the Main Camp/Administration Area of MCAGCC began in April 1981, when data from 373 gravity and ground-magnetic stations were determined in the area directly west of Camp Wilson, including the Surprise Spring and Sand Hill areas. This survey was expanded in March 1983 to the north, east, and south when data from an additional 387 gravity and ground-magnetic stations were recorded.

The 760 gravity stations were taken at existing benchmarks or were set by using a Wild T-1 theodolite and two wide-faced rods; elevation accuracies were better than 0.4 foot. Gravity was measured at each station by a LaCoste and Romberg gravity meter (Model G-No. 144) in a series of 4-hour drifts with checkpoints. The survey was tied to USGS Bench Mark A-726 near the Joshua Tree National Monument Visitors Center. Raw station data were then reduced with the 1967 latitude correction (Telford and others, 1976) assuming a reduction density of 2.40 g/cm^3. Terrain corrections were taken in the field to a distance of 175 feet (Zone C of a Hammer chart in Dobrin, 1976), then with a computer through approximately 72,000 feet (Zone M, Dobrin, 1976).

Appendix B lists the results of this gravity survey in tabular form, and Figure 11 shows the results on a map plotted using a reduction density of 2.40 g/cm^3 and contoured on an interval of 1 mgal. The map shows two low anomalies; one is directly west of the Main Camp/Administration Area and the other (unclosed) is northeast of Deadman Lake. Both lows are interpreted as being caused by a great thickness of lower-density sediments overlying the basement in basins or grabens. In the southeast a steep gravity gradient (approximately 10 mgals/mi) indicates the presence of the West Bullion Mountain–Mesquite Lake fault zone, which defines the western face of the West Bullion Mountains. West of the Main Camp/Administration Area the gravity increases more subtly until it crosses the Surprise Spring Fault, where local gravity highs define the Sand Hill area and the extreme southern part of Hidalgo Mountain.

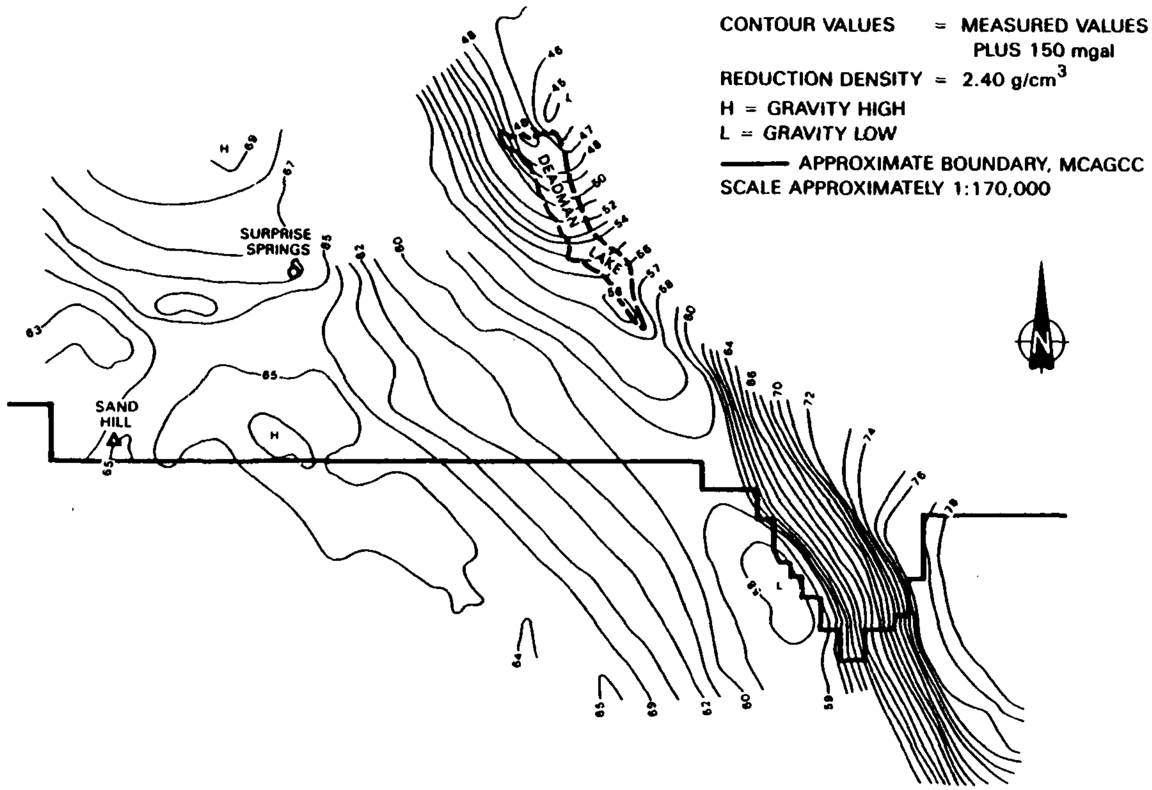


FIGURE 11. Complete Bouguer Gravity Map of the Main Camp/Administration Area. Contour interval is 1 mgal; contour values equal measured values plus 150 mgal. Reduction density is 2.40 g/cm^3.

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The Navy's gravity results and those of Moyle (1984) are similar. Moyle's survey provided more aerial blanketing of MCAGCC, whereas the Navy's survey provided closer coverage and thus finer detail in some areas. One important value that Moyle was able to determine was depth-to-basement estimates, and therefore thickness of sediment west and north of the Main Camp/Administration Area. Using information from wells and drill holes scattered throughout the study area (although only three actually penetrated basement), Moyle was able to calculate depths of slightly over 4000 feet beneath Mesquite Lake Playa and over 10,000 feet beneath Deadman Lake Playa. Moyle points out that these depths could be off by as much as 25% and believes that his estimates are too shallow. If this is so, the sedimentary thickness beneath Mesquite Lake Playa could be as much as 5000 feet and the thickness beneath Deadman Lake Playa as much as 13,000 feet.

GROUND MAGNETICS

The ground-magnetic survey used a Geometrics magnetometer and was done in conjunction with the gravity survey's 760 data points. No recording base station was used. The data were smoothed by repetitive recording from base stations and checkpoints. Appendix B contains all data on the ground-magnetic survey from the Main Camp/Administration Area.

Figure 12 shows the results of the ground-magnetic survey. The map of the ground-magnetic survey has the same general features as the aeromagnetic map (see Plate 1) in this area of MCAGCC but with finer detail, including the deflection of the magnetic contours north of the southern boundary line of the Center. The magnetic low near Deadman Lake is a prominent feature of the ground-magnetic map, as is a low near Mesquite Lake Playa. The interesting feature on the map, however, is the narrow magnetic high that trends roughly N60°E through the Main Camp/Administration Area. This feature may be interpreted as a buried pipeline or powerline running along one of the magnetic traverse lines, or it might be a shallow intrusive structure such as a dike. The fact that the high is not delineated within the Main Camp/Administration Area on the aeromagnetic map seems to reinforce that it is a shallow feature with the aeromagnetic signature masked by the overpowering lower magnetic field strength of the surrounding sediment-filled basins.

FIELD STUDIES: THERMAL-GRADIENT DRILLING

Thermal-gradient drilling at MCAGCC, Twentynine Palms was completed entirely on Marine lands based upon two primary reasons:

1. All of the geothermal projects within the Navy, whether in the developmental or planning stages, are being accomplished through third-party contracting. This form of contracting allows the development of the geothermal resource, which is located on Navy- or Marine Corps-controlled lands, by a private contractor using only the contractor's funds. In essence, it is a no-cost-to-the-Government contract. The Government simply supplies the resource.

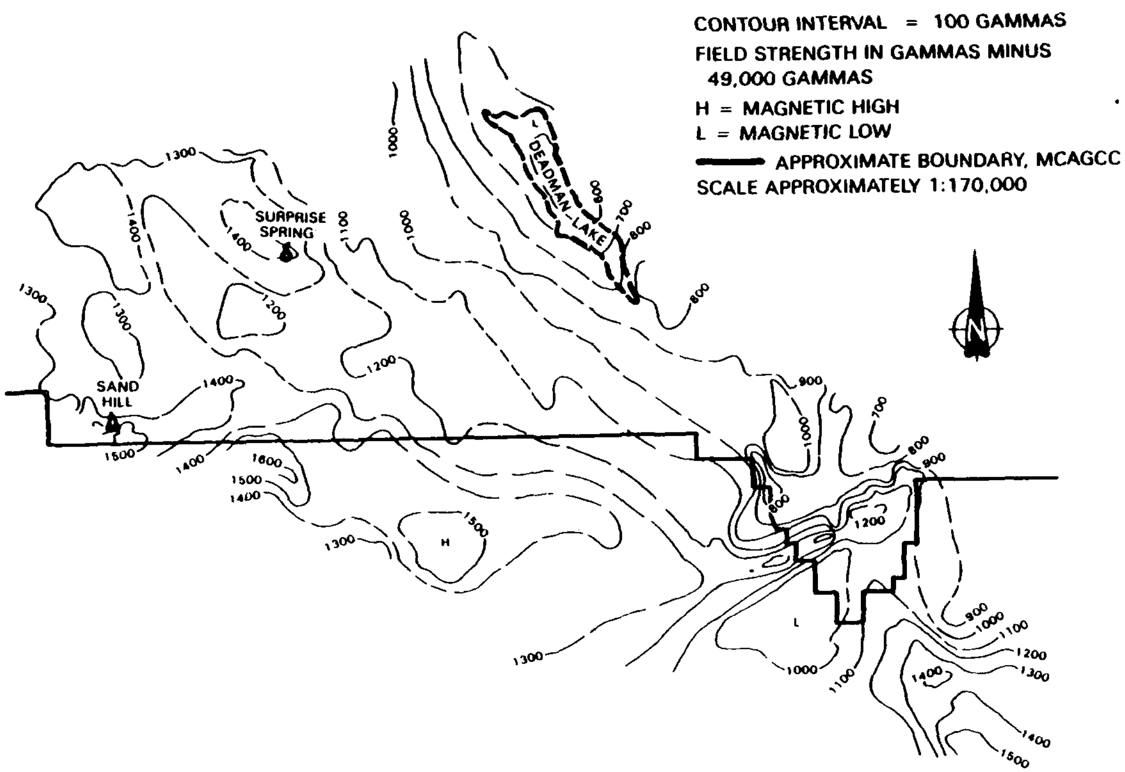

FIGURE 12. Total Intensity Ground-Magnetic Map of the Main Camp/Administration Area. Contour interval is 100 gammas; map values are measured values minue 49,000 gammas.

2. On Naval and Marine Corps reservation lands, the Commanding Officer of the Western Division, Naval Facilities Engineering Command acts as the Area Geothermal Supervisor. Although all geothermal drilling is accomplished under applicable geothermal resource orders (GROs), this assignment of responsibility gives the Department of the Navy direct control of the drilling project.

Although any drilling that might have been done off MCAGCC-controlled lands in areas that had shown greater evidence for a hotter or shallower resource might have benefited other governmental agencies, such drilling would not have benefited the Marine Corps.

Thermal-gradient drilling was performed at MCAGCC from December 1983 through January 1984. Seven holes were drilled as part of a cooperative research and development program jointly funded by the Navy and Department of Energy. Drilling sites were chosen by the Geothermal Program Office (then the Geothermal Utilization Division) at NWC, China Lake, Calif. All sites were cleared environmentally by qualified personnel from China Lake (Figure 13). The Division of Earth Sciences, University of Nevada, Las Vegas, was selected to contract and observe the drilling of the thermal-gradient holes (see Trexler and others, 1984).

SITE SELECTION

After the raw data were reduced and interpreted from the first Deadman Lake survey of April 1981, five drill sites were located near Surprise Spring consisting of three primary and two secondary locations. The primary sites were 72-2, 11-10, 63-8, T.2N., R.7E.; the secondary sites were 12-13, T.2N., R.7E. and 26-34, T.3N., R.7E. (Figure 13). These sites were chosen primarily from the geophysics and the known temperature regime within and south of MCAGCC. The holes were located to straddle the Surprise Spring Fault. With the expansion of the Deadman Lake survey in March, 1983, seven additional sites (78-33, 78-29, 45-28, 43-20, 81-21, T.2N., R.9E.; 13-4, T.1N., R.9E.; and 78-16, T.2N., R.8E.) were located in and near the Main Camp/Administration Area (Figure 13). The locations of these sites were based on geophysics and the assumption that the West Bullion Mountain/Mesquite Lake fault zone could be acting as a conduit for geothermal fluids into the Main Camp/Administration Area. It was known that warm geothermal fluids were present along that fault trace just south of the Center.

In addition, one hole was tentatively sited in the Lavic Lake area, just south of the lake itself and near circular low aeromagnetic and gravity anomalies (see Site-Specific Studies: Lavic Lake).

HOLE-BY-HOLE DRILLING

Initially, the seven sites at and near the Main Camp/Administration Area were chosen to be drilled. However, as the holes were drilled it became obvious that alternate drill sites would be needed to determine if any of the geothermal fluids located south of MCAGCC extended onto the Center. The following discussion is a brief description of the drilling and the thermal-gradient measurements at each drill site. The rationale for changing the drilling plan will also be discussed. All descriptions below pertaining to drilling and recorded

temperatures are abstracted from Trexler and others, 1984. No funds were available to flow-test the holes after they were drilled, and no attempt was made to unload the holes to retrieve possible fluid samples for chemical analysis.

Thermal gradients were calculated by subtracting the mean annual surface temperature at Twentynine Palms of 67.5°F (19.7°C) from the bottom-hole temperature, then dividing that number by the depth of the drill hole (Reddick, 1983). That result is multiplied by 100 to report gradients in °F/100 ft.

Thermal-Gradient Hole No. 1 (site 78-33, T.2N., R.9E.) (Figure 13) was drilled on the eastern (upthrown) side of the West Bullion Mountain/Mesquite Lake fault zone to a total depth of 880 feet (268 m). The hole encountered quartz monzonite (bedrock) at 640 feet (195 m). Mud-return temperatures were never higher than 81°F (27°C). The thermal gradient, as measured on 28 February 1984, was 2.65°F/100 ft (4.81°C/100 m). A maximum temperature of 91°F (32.6°C) was measured at a depth of 880 feet (268 m). Figure 14 graphically depicts the lithology and thermal gradient from hole No. 1.

Thermal-Gradient Hole No. 2 (site 13-4, T.1N., R.9E.) (Figure 13) was drilled approximately 4500 feet west of hole No. 1, on the southern margin of Mesquite Lake, and as near to the Center's southern boundary line as possible. It was hoped that geothermal fluids migrating along the Mesquite Lake Fault would be encountered. The hole was drilled to a depth of 1000 feet (305 m), did not encounter bedrock, and had maximum mud-return temperatures of only 81°F (27°C). Thermal-gradient measurements were taken on 14 and 28 February 1984. A thermal gradient of 1.82°F/100 ft (3.3°C/100 m) was observed on 28 February with a maximum temperature of 85.6°F (29.8°C) at total depth (1000 feet). The thermal gradient and lithologic log for hole No. 2 is shown in Figure 15.

Thermal-Gradient Hole No. 3 (site 78-29, T.2N., R.9E.) (Figure 13) was drilled 1.3 miles to the north of hole No. 2 and within the large gravity gradient that defines the West Bullion Mountain/Mesquite Lake fault zone. The hole was completed to a depth of 1100 feet (335 m), did not encounter bedrock, and had a maximum mud-return temperature of 86°F (30°C). The thermal gradient was measured on 13 and 18 February 1984 and was calculated at 2.1°F/100 ft (3.8°C/100 m) using temperatures from the later date. The maximum recorded temperature was 90.5°F (32.5°C) at 1100 feet. Lithologic and thermal-gradient data for hole No. 3 are shown in Figure 16.

After the drilling of Thermal-Gradient Hole No. 3, it became obvious to all those involved in the drilling program that the West Bullion Mountain/Mesquite Lake fault zone was not channeling any geothermal fluids into the Main Camp/Administration Area. Personnel from the Division of Earth Sciences and the Geothermal Program Office decided to drill Thermal-Gradient Hole No. 4 at site 81-21, T.2N., R.9E. (Figure 13), on the eastern side of the West Bullion Mountains. Hole No. 4 was drilled to a depth of 920 feet (280 m). Drilling encountered weathered bedrock at approximately 740 feet (226 m) and relatively unaltered quartz monzonite at 890 feet (271 m). Maximum temperature measured on 28 February 1984 was 87°F (30.7°C) at 920 feet (280 m). The temperature gradient was calculated as 2.2°F/100 ft (3.9°C/100 m). Figure 17 shows the lithologic and temperature information from hole No. 4.

Upon the completion of Thermal-Gradient Hole No. 4, sites 45-28 and 43-20, T.2N., R.9E. (Figure 13) were dropped from the drilling program because it had become apparent that no shallow geothermal fluids were obtainable beneath the Main Camp/Administration

Area. Personnel from the Division of Earth Sciences and the Geothermal Program Office decided to drill 78-16, T.2N., R.8E. and to request permission from MCAGCC to enter the live training ranges to drill one hole at either site 72-2 or 11-10, T.2N., R.7E. (Figure 13), and one hole in the Lavic Lake area.

Thermal-Gradient Hole No. 5 (site 78-16, T.2N., R.8E.) (Figure 13) is located approximately 4 1/2 miles WNW of the Main Camp/Administration Area and only 50 feet north of the southern boundary of the Center. Hole No. 5 was sited on the eastern flank of a relatively large ground-magnetic high and was due north of a known hot domestic well in the Desert Heights area of Twentynine Palms. Initially the hole was to be drilled to a depth of 1100 feet (335 m), but at 940 feet (287m) a drill-bit change was required and circulation was lost after reentering the hole. Attempts to regain circulation failed, compelling Division of Earth Sciences personnel to complete the hole at 940 feet. The hole was drilled entirely in sediments; maximum mud-return temperatures were 93°F (34°C) during drilling, which gave a positive indication of possible geothermal heat at a shallow depth. Thermal-gradient measurements were made on 15 and 28 February 1984. The highest temperature measured was 125°F (51.6°C) at 940 feet (287 m) on 15 February 1984, giving a thermal gradient of 6.1°F/100 ft (11.1°C/100 m). Figure 18 gives lithologic and temperature data for hole No. 5

During the drilling of Thermal-Gradient Hole No. 5, permission was granted to enter the southern live training ranges of the Center. Permission to enter the Lavic Lake area was understandably denied because of maneuvers and the large amount of unexploded ordnance in that area. Other logistical problems associated with drilling at Lavic Lake would have included possible road building and the large distance needed to transport water for drilling use. Therefore, it was decided to drill both sites 72-2 and 11-10, T.2N., R.7E. in the southern training ranges.

Thermal-Gradient Hole No. 6 was drilled on the eastern side of the Surprise Spring Fault at site 72-2, T.2N., R.7E. (Figure 13). The hole was drilled to a depth of 1095 feet (334 m) in sediments and gave maximum mud-return temperatures of 103°F (39.4°C). A maximum temperature of 153°F (67.1°C) was recorded at 1095 feet (334 m) on 27 February 1984; the thermal gradient was measured at 7.8°F/100 ft (14.2°C/100 m). However, the thermal gradient did flatten out towards the bottom of the hole and approached 2.0°F/100 ft (3.7°C/100 m) from approximately 900 feet to total depth. Although this lower thermal gradient is still positive, it is possible that the hole penetrated the Surprise Spring Fault at about 900 feet and was quenched by the apparent cooler temperatures on the western side of the fault. Another interpretation is that from approximately 900 feet to total depth the hole intersected a warm-water aquifer. There is a slight indication that temperatures again begin to rise at total depth. Figure 19 shows the lithology and temperature data of Thermal-Gradient Hole No. 6.

Thermal-Gradient Hole No. 7 was drilled about 1 1/2 miles southwest of No. 6 at site 11-10, T.2N., R.7E. on the western side of the Surprise Spring Fault (Figure 13). The hole was drilled through sediments, had a maximum mud-return temperature of 73°F (23°C), and was completed at a depth of 1060 feet (323 m). A maximum temperature of 93°F (33.9°C) was measured at 1060 feet (323 m) on 14 February 1984 with no appreciable difference when remeasured on 27 February 1984 The thermal gradient is calculated as 2.4°F/100 ft (4.4°C/100 m). Figure 20 graphically indicates the thermal gradient and lithology of Thermal-Gradient Hole No. 7.

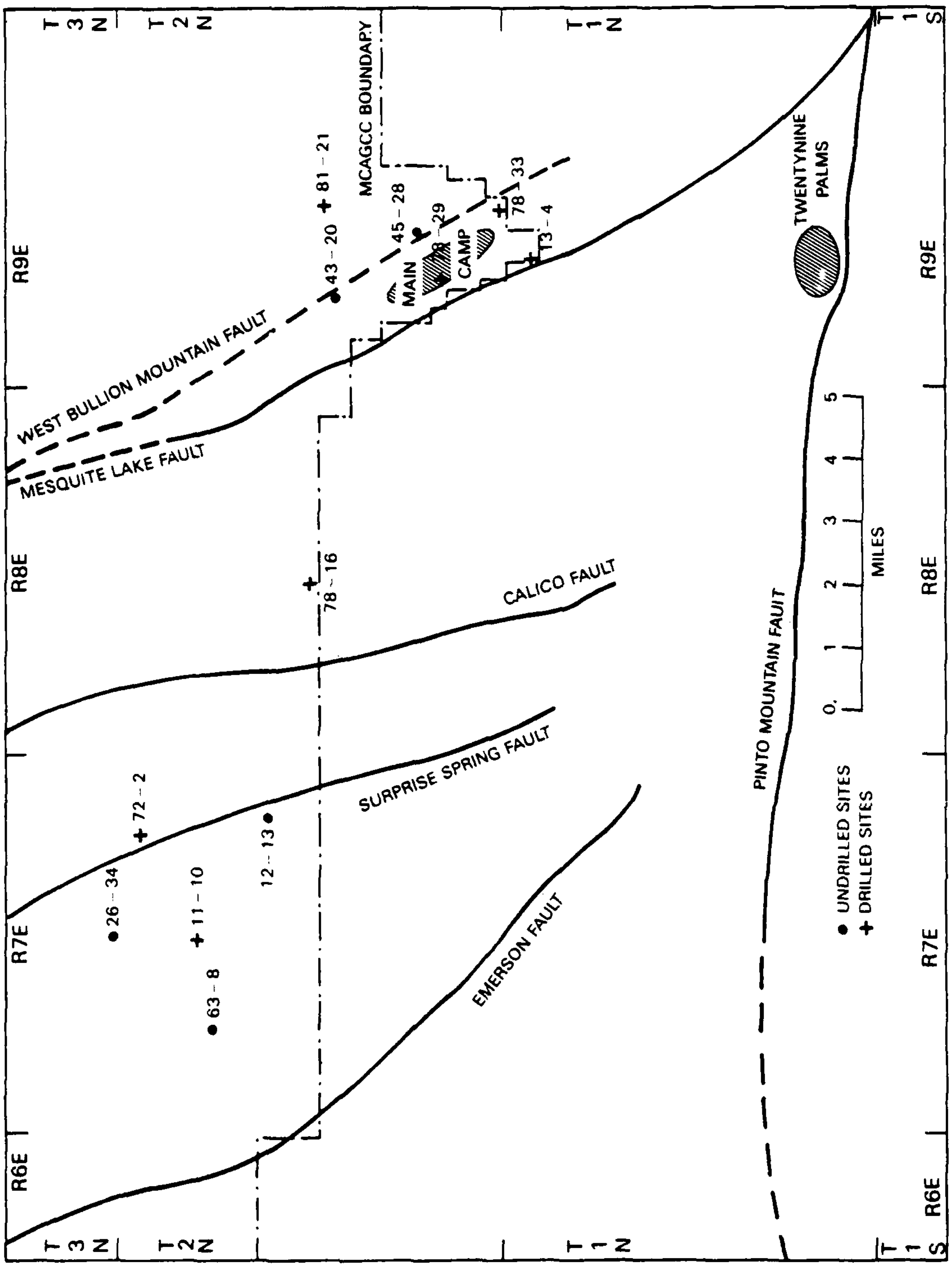

FIGURE 13. Location of Environmentally Cleared Drill Sites at MCAGCC, Twentynine Palms.

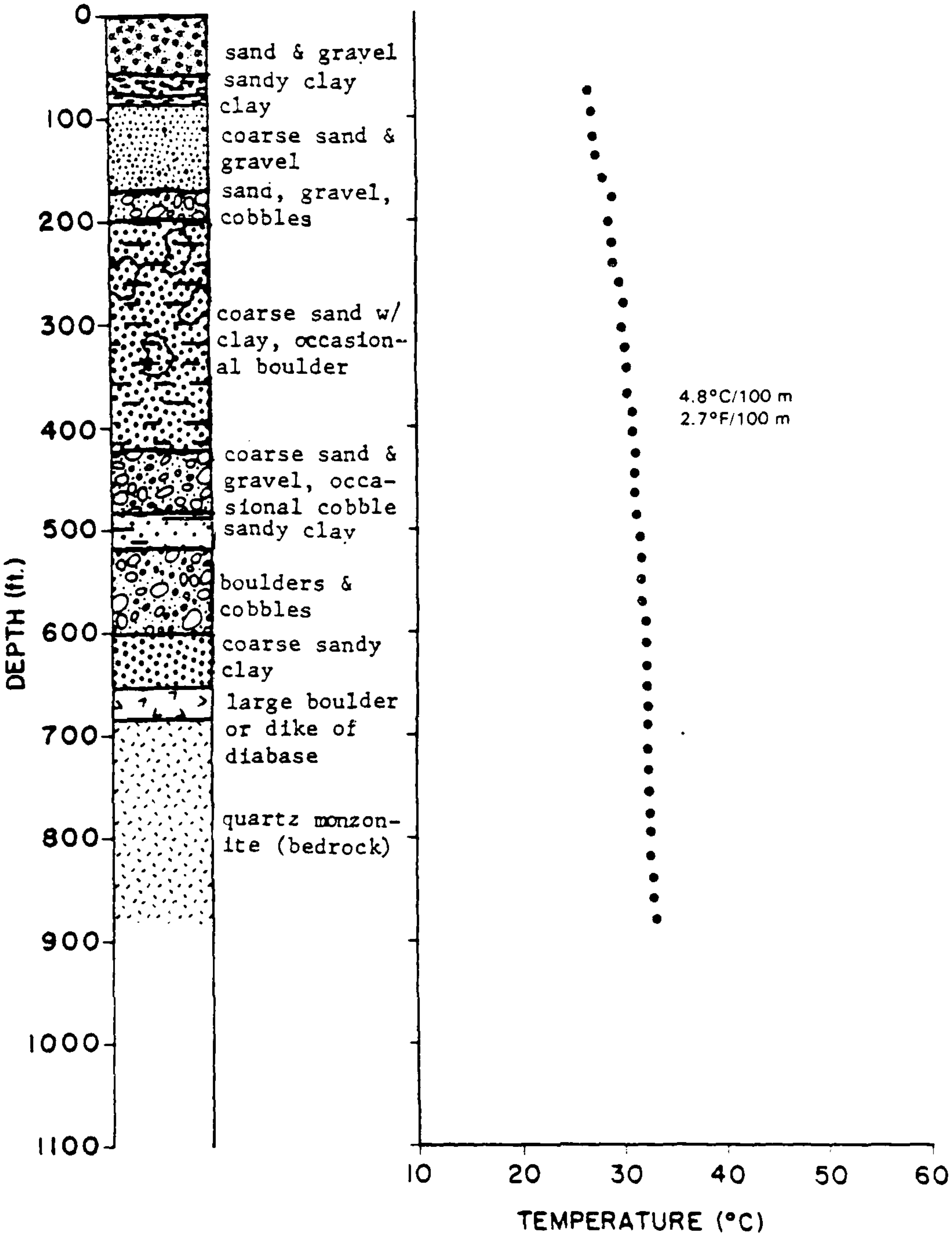

FIGURE 14. Thermal-Gradient Hole No. 1–Lithologic Log and Temperature-Depth Profile. Modified from Trexler and others, 1984.

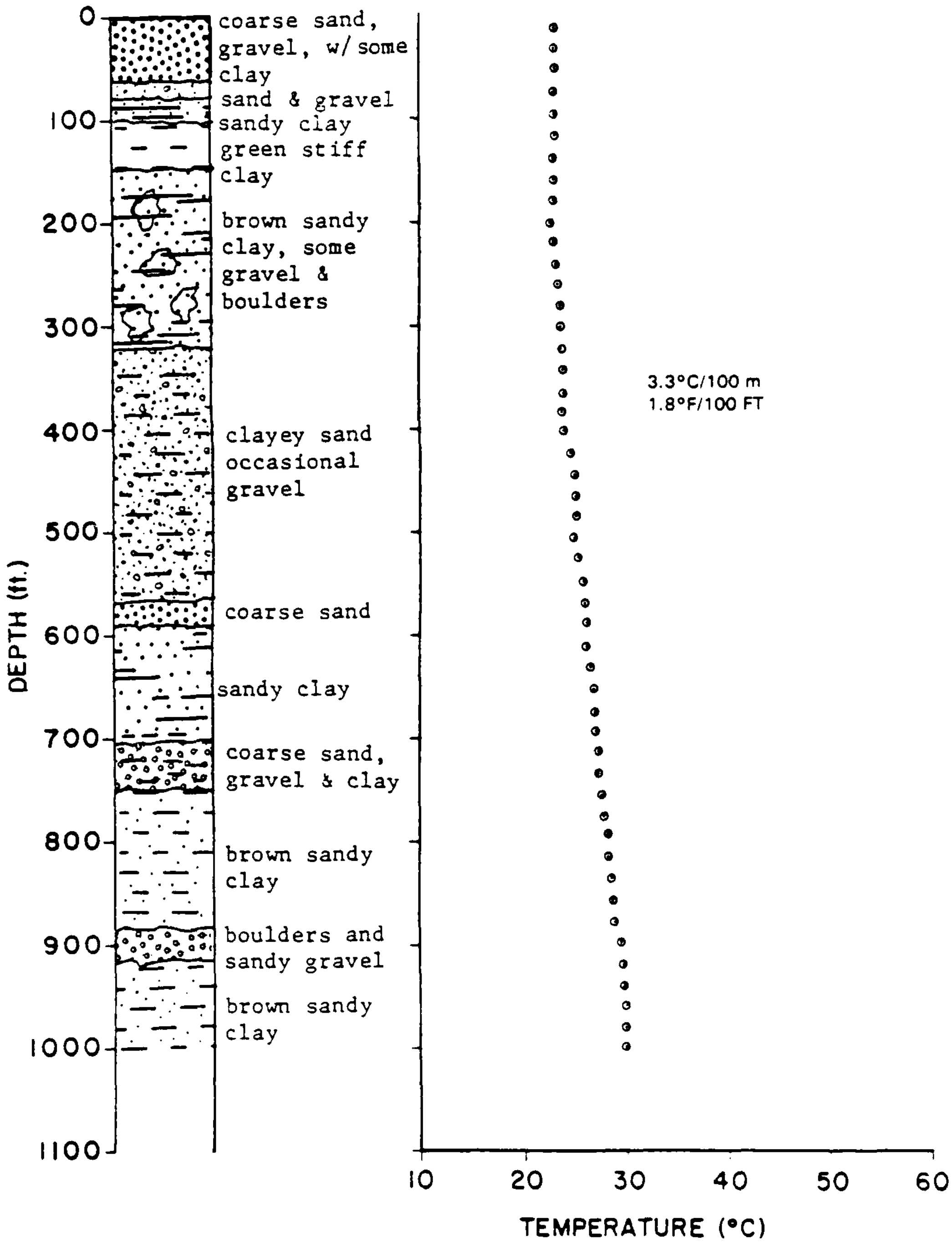

FIGURE 15. Thermal-Gradient Hole No. 2–Lithologic Log and Temperature-Depth Profile. Modified from Trexler and others, 1984.

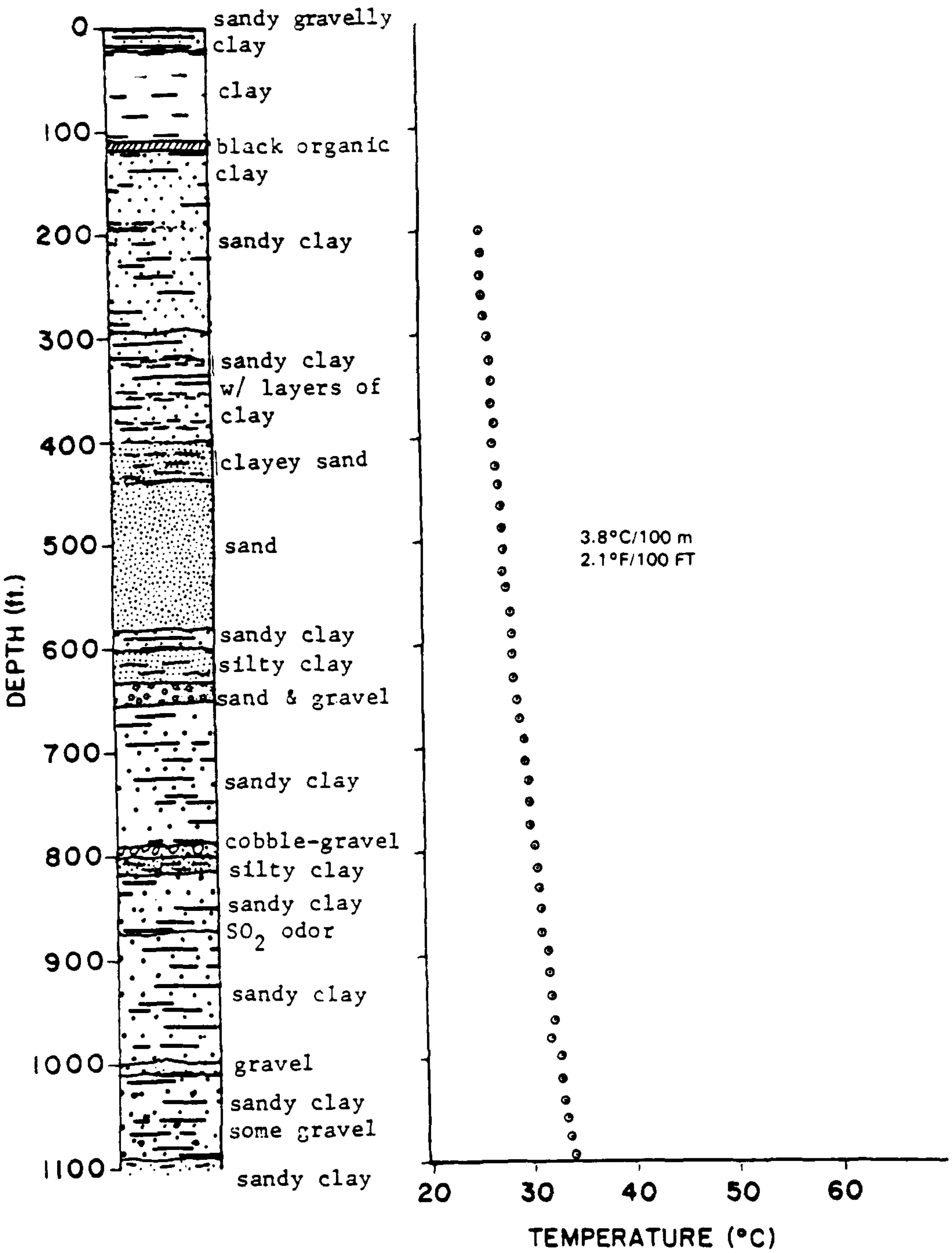

FIGURE 16. Thermal-Gradient Hole No. 3–Lithologic Log and Temperature-Depth Profile. Modified from Trexler and others, 1984.

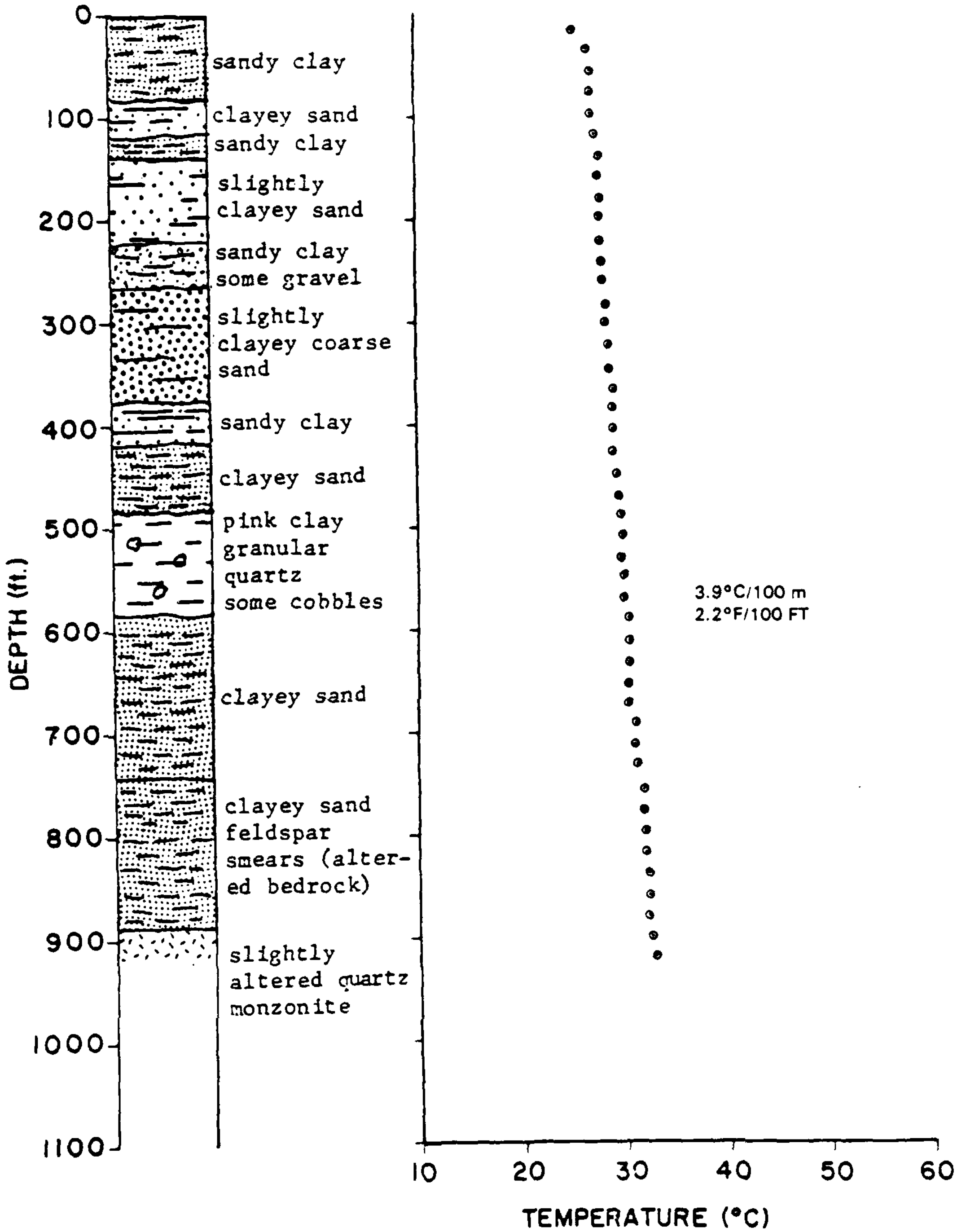

FIGURE 17. Thermal-Gradient Hole No. 4–Lithologic Log and Temperature-Depth Profile. Modified from Trexler and others, 1984.

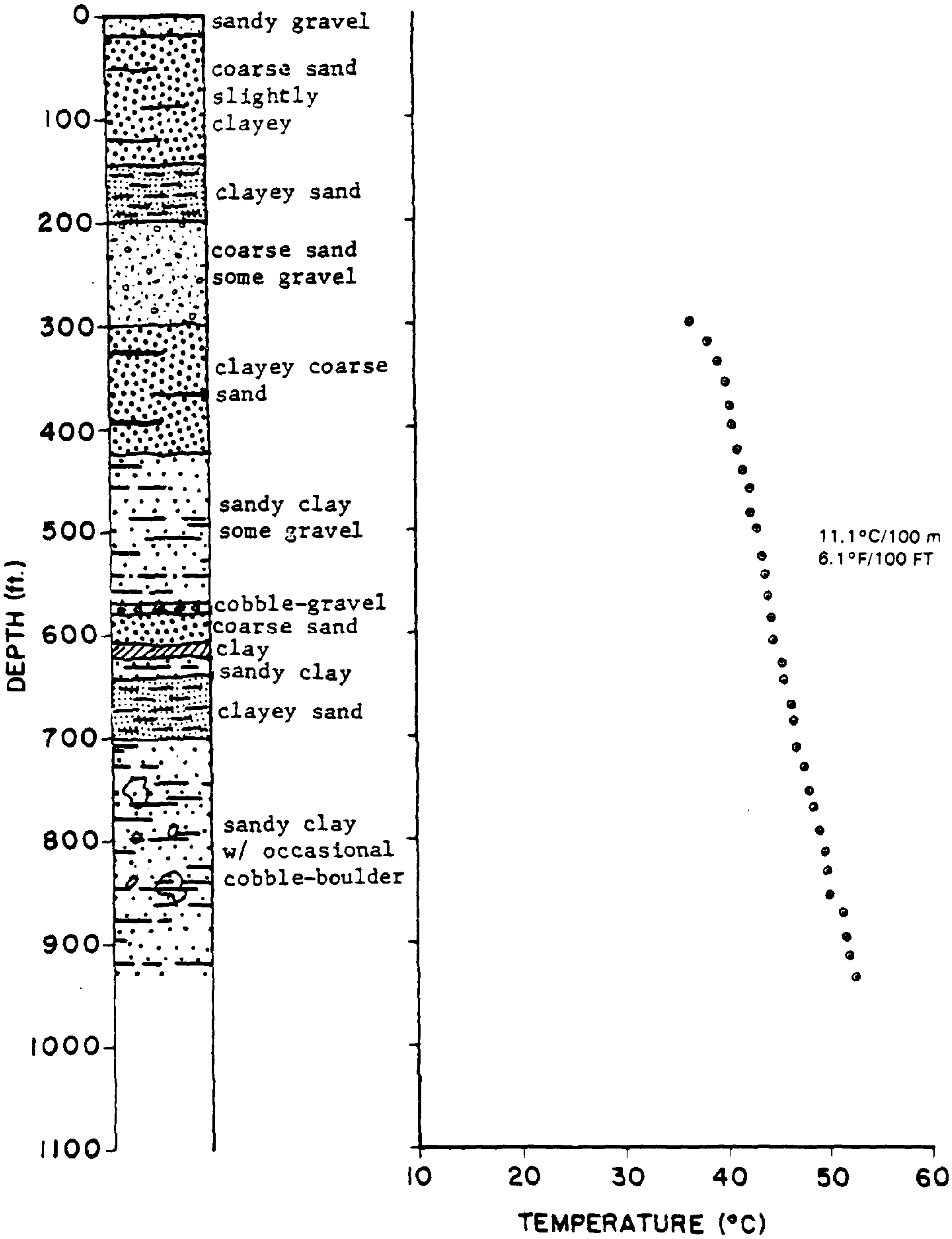

FIGURE 18. Thermal-Gradient Hole No. 5–Lithologic Log and Temperature-Depth Profile. Modified from Trexler and others, 1984.

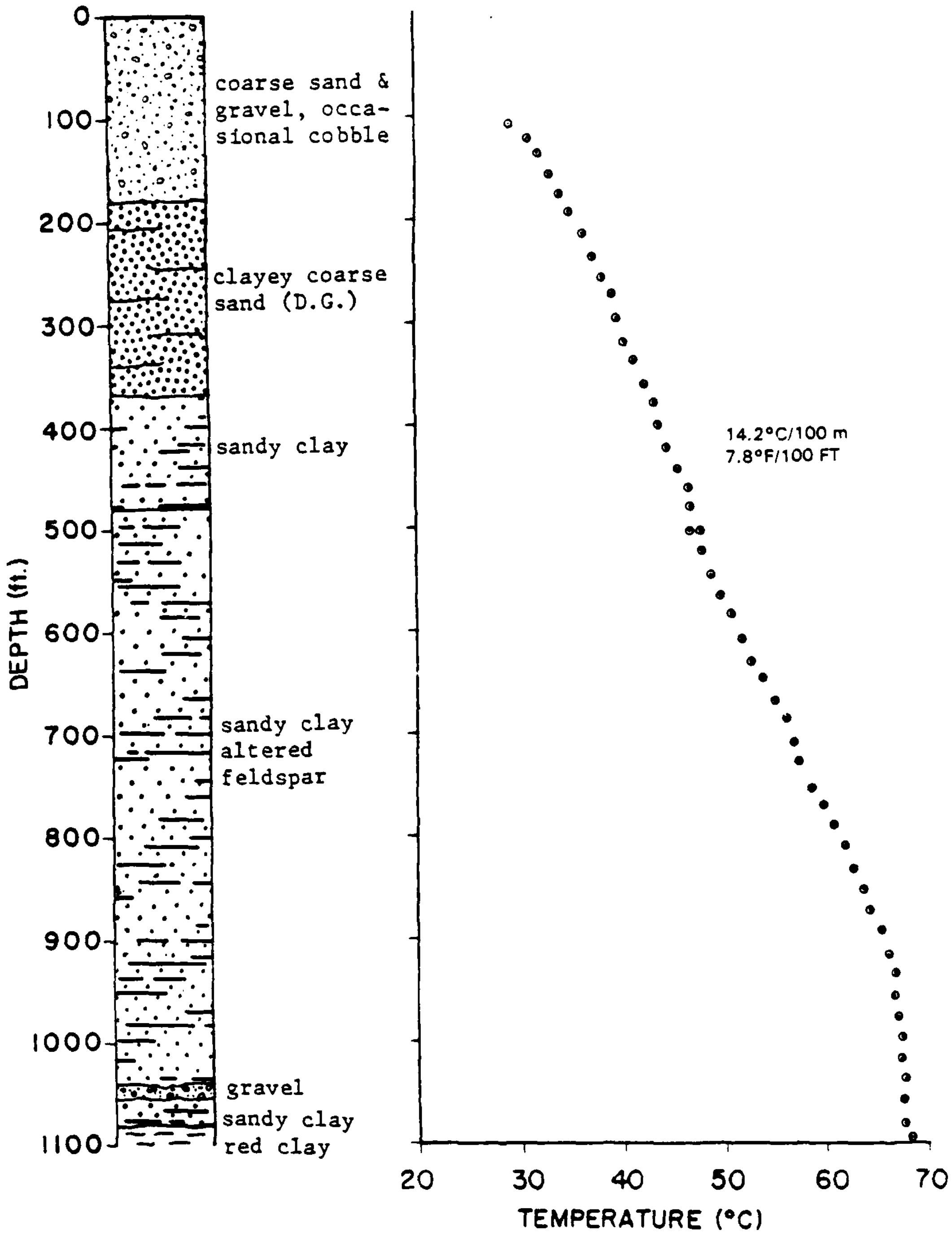

FIGURE 19. Thermal-Gradient Hole No. 6–Lithologic Log and Temperature-Depth Profile. Modified from Trexler and others, 1984.

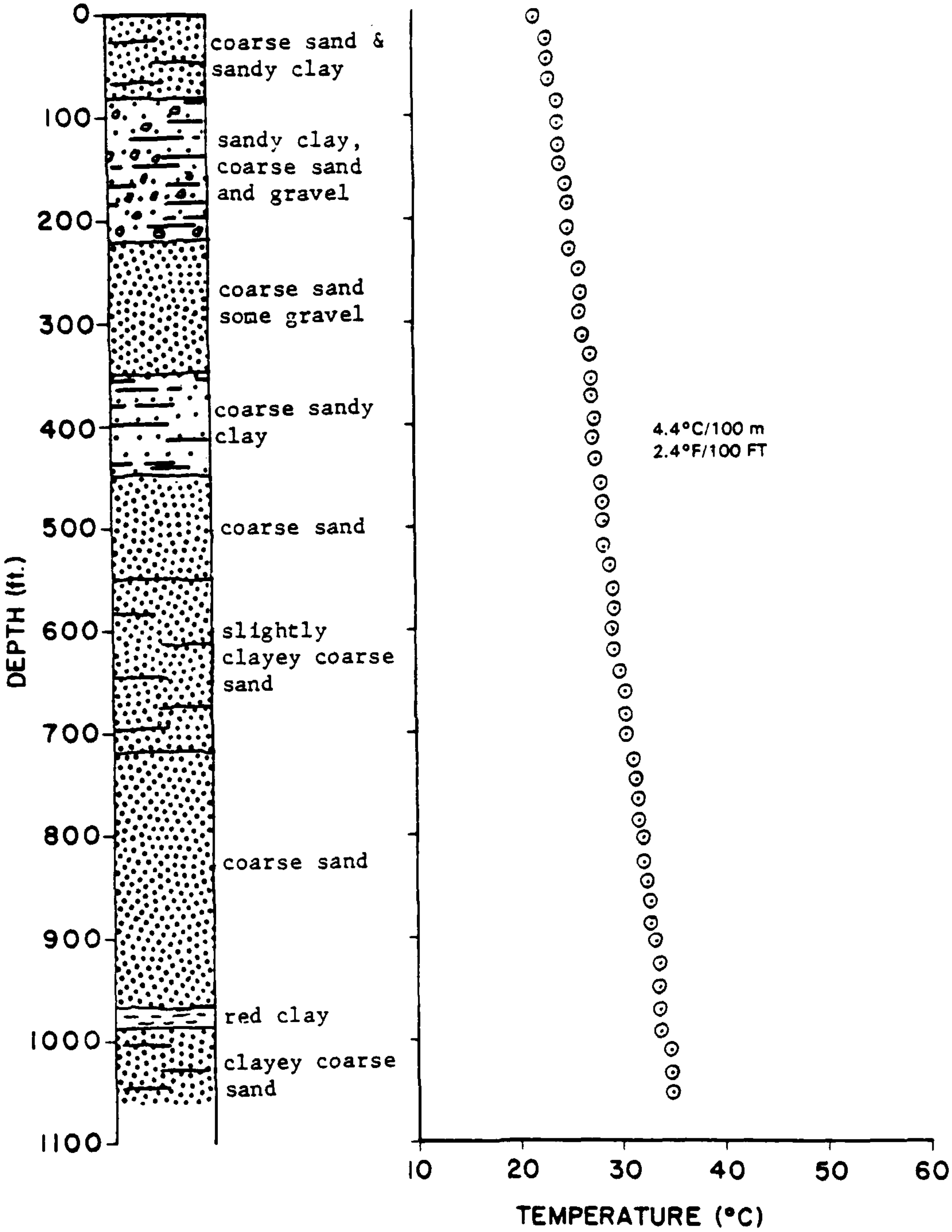

FIGURE 20. Thermal-Gradient Hole No. 7–Lithologic Log and Temperature-Depth Profile. Modified from Trexler and others, 1984.

DISCUSSION

Both measured well temperatures and chemical geothermometry indicate the presence of a low-temperature geothermal resource between the town of Twentynine Palms and the Marine Corps Air Ground Combat Center. This presence has been verified by both the URS Corporation (1985) and the Geothermal Program Office at China Lake. However, because of the lack of information concerning wells drilled on MCAGCC it is not possible to determine, using these methods, the exact area extent of the resource beneath MCAGCC-controlled lands near the Main Camp/Administration Area. However, it is believed that at least 4500 acres of MCAGCC lands are underlain by this resource.

Geophysics performed by both Moyle (1984) and the Geothermal Program Office indicate large geophysical lineations cutting through these delineated low-temperature resource zones. From these data, it appears as if these trends could be local faults controlling the flow of fluids. These trends underlie the mapped traces of the West Bullion Mountain, Mesquite Lake, and, to some extent, the Surprise Spring Faults.

A working model was developed in which mapped geophysical lineations are considered faults that act as conduits providing geothermal fluids from the south to MCAGCC. To test this model and provide more information concerning the subsurface temperature regime near the Main Camp/Administration Area, the Geothermal Program Office and the Department of Energy drilled seven thermal-gradient holes at MCAGCC. Results of this drilling seem to indicate that fluids from the low-temperature resource zones located south of MCAGCC are not being channeled into the Main Camp/Administration Area by the West Bullion Mountain Fault or the Mesquite Lake Fault. However, indications are that the Surprise Spring Fault has some control of geothermal fluids by being both a conduit and a barrier, pooling geothermal fluids east of the fault. It is not certain if these fluids are migrating north along the fault from the known geothermal resources south of MCAGCC, or if the fluids are migrating from an unknown resource lying north of the area in an unexplored region of the Center.

SITE SPECIFIC STUDIES: LAVIC LAKE

HYDROLOGY

Main hydrological studies of the Lavic Lake area were done by Thompson (1929) and Moyle (1967). Thompson reported on a well located a short distance from a lava flow that defined the southern end of the Lava Bed Mountains (Figure 21). This well provided water to the Sunshine Mine and is located in Section 4, T.6N., R.6E. The depth of the well (presumably in 1917) was reported to Thompson as being between 120 and 130 feet, and depth to water was 85 feet. The well was reported to yield 25 to 30 gallons a minute without any appreciable drawdown. The water quality from the well was highly mineralized with 1679 parts per million total dissolved solid. Main constituents were sodium sulfate, chloride, and some reported arsenic.

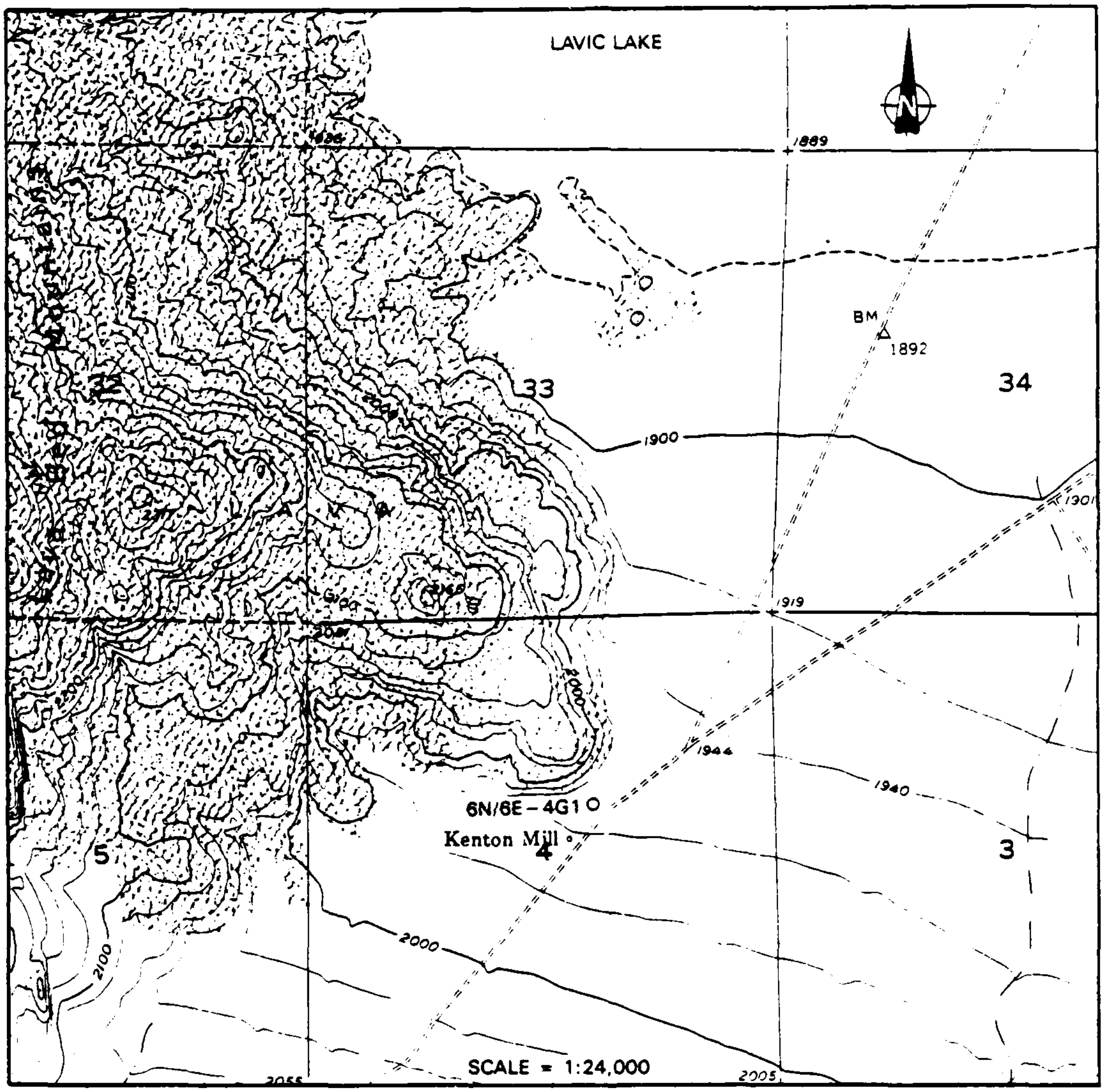

FIGURE 21. Location of Well 6N/6E-4G1 Near Lavic Lake.

Thompson also reports on a well, known as the Sutter well, located about 4.5 miles southeast of the old town of Lavic (about 3.5 miles north of Lavic Lake). The well was apparently located in some rocky hills, not in the alluvium-filled valley, and was 72 feet deep with depth to water at 64 feet. The well was said to have yielded close to 200,000 gallons of water in 24 hours. No information on water quality was reported.

A third well reported by Thompson is located on the west side of Lavic Lake, approximately in Section 20, T.7N., R.8E. The well was reported to be 59 feet deep and, on 9 February 1918, water was measured at 53 feet beneath the level of the ground. Thompson was unable to obtain a water sample for analysis.

Waring (1915) and Moyle (1967) report on a spring known as Peacock Spring located about 10 miles south of the town of Lavic in Section 20, T.6N., R.6E. The spring was flowing (about 1 gallon per minute) in 1910 but has since dried up. Temperature of the spring was reported to be 55°F (Waring, 1915).

Thompson reports that the water table lies at 50 feet below Lavic Lake. He believed that there must be an underground drainage to the northwest of Lavic Lake to explain what he considered a deep water table. In such a drainage, the water would drain through alluvial deposits that lie beneath the lava flows of Pisgah Crater to Troy Dry Lake, located northwest of the lava flow. To substantiate his theory, Thompson noted that the water level in the Sunshine Mine well in Lavic Lake Valley was 80 feet higher than the water level beneath Troy Dry Lake. This gives a gradient of only 6 feet per mile between the two playas.

WELL TEMPERATURES AND CHEMICAL GEOTHERMOMETERS

As reported before, the only water sample available for analysis from the Lavic Lake area was taken 27 November 1917 from well-site 6N/6E-4G1. This well provided water for the Sunshine Mine (Kenton Mill?) and the water was of the sodium-sulfate-chloride type. The quartz-conductive-cooling geothermometer gave a temperature for that analysis of 89°C, the Na-K-Ca geothermometer gave 117°C, and the Na-K-Ca geothermometer corrected for magnesium gave 83°C. Thus, the chemical geothermometry indicates a possible 90°C+ resource in the Lavic Lake area.

For comparison, waters from the Amboy Crater area, northeast of the Center and 40 miles east of Lavic Lake, include a pure sodium-chloride brine (sampling site 6N/12E-29P1; with high total dissolved solids), an impure sodium-chloride brine (sampling sites 6N/11E-30G1 and 6N/12E-35F1; with minor calcium, magnesium, and sulfate with no bicarbonate or carbonate), and a sodium-calcium-sulfate water (sampling site 6N/12E-32A1; $Na + K \geq Ca > Mg, SO_4 \gg Cl + F \geq HCO_3 + CO_3$).

GEOPHYSICAL STUDIES

Gravity

Geophysical field studies in the Lavic Lake area were conducted in September 1982 and consisted of combined gravity and ground-magnetic surveys taken at 214 stations. Extreme care had to be taken in these surveys because of the large amount of ordnance–both exploded and unexploded–that was strewn about the Lavic Lake bombing range. Other obstacles that prevented station spacing on the surveys as tight as desired included washed-out roads and deep mud caused by summer thunderstorms.

As in the gravity survey at the Main Camp/Administration Area, the gravity stations at Lavic Lake were either located at existing benchmarks or set by use of surveying

equipment. Gravity was measured at each station by the Model G-No. 144 LaCoste and Romberg gravity meter in a series of 4-hour drifts with checkpoints. The survey was tied to Station CH293 (U.S. Coast and Geodetic Survey Bench Mark Y-161) of the California Gravity Base Station Network (Chapman, 1966) in Ludlow, Calif. Raw station data were then reduced with the 1930 latitude correction (Telford and others, 1976), assuming a reduction density of 2.40 g/cm^3. As before, terrain corrections were taken in the field to a distance of 175 feet, then with a computer through approximately 72,000 feet.

Appendix C lists the results of the Lavic Lake gravity survey in tabular form, and Figure 22 shows the results on a map plotted using a reduction density of 2.40 g/cm^3 and contoured on an interval of 1 mgal. The most obvious feature on the map is the emergence of an unclosed gravity low directly south of Lavic Lake. While the survey spacing was not tight enough to provide fine detail, the gravity low anomaly definitely has circular dimensions. The anomaly itself is probably the result of a thick sequence of low-density sediments overlying the basement, but it is not certain if the defining feature was caused by faulting that formed a structural basin or by the collapse of a volcanic vent.

Gravity highs are located to the northeast and northwest of the gravity low. The cause of the unclosed gravity high to the northeast is uncertain but probably is the Pliocene basalts of the Lava Bed Mountains as mapped by Dibblee (1966), whereas the high gravity ridge to the northwest is attributable to Tertiary dacite porphyry near Sunshine Peak. The basalt flows of Pisgah and Sunshine Craters appear to have a very slight low-gravity signature associated with them, probably because the flows are thin.

Ground Magnetics

The ground-magnetic survey at Lavic Lake was performed in the same manner as the one at the Main Camp/Administration Area. Appendix C contains all data on this ground-magnetic survey.

Figure 23 shows the results of the Lavic Lake survey. The map is somewhat hard to interpret because of the lack of closely spaced stations over much of the survey area. In comparison with the aeromagnetic survey, the ground-magnetic survey produced numerous moderate magnetic highs not seen from the air. This is again because of the finer detail of the ground survey. The ground-magnetic map shows a roughly north-south trend of magnetic highs along the east-central portion. The northeastern high, although small, is thought to be caused by the basalts of the Lava Bed Mountains. The larger magnetic high beneath Lavic Lake is probably resultant from either a shallow buried basalt flow of Pisgah or Sunshine Craters, or from a buried volcanic plug beneath the lake. The low-magnitude magnetic high south of Lavic Lake, directly over the large gravity low discussed in the Gravity section of this report, is ambiguous. This high is probably attributable to rock type, but could also be accounted for by the large amount of ordnance in the area as well as the existence of mining paraphernalia left at Kenton Mill. In the western portion of the map, the magnetic signature decreases from north to south across the Sunshine Peak area. The magnetic high north of Sunshine Peak is caused by the basaltic flows of Pisgah Crater.

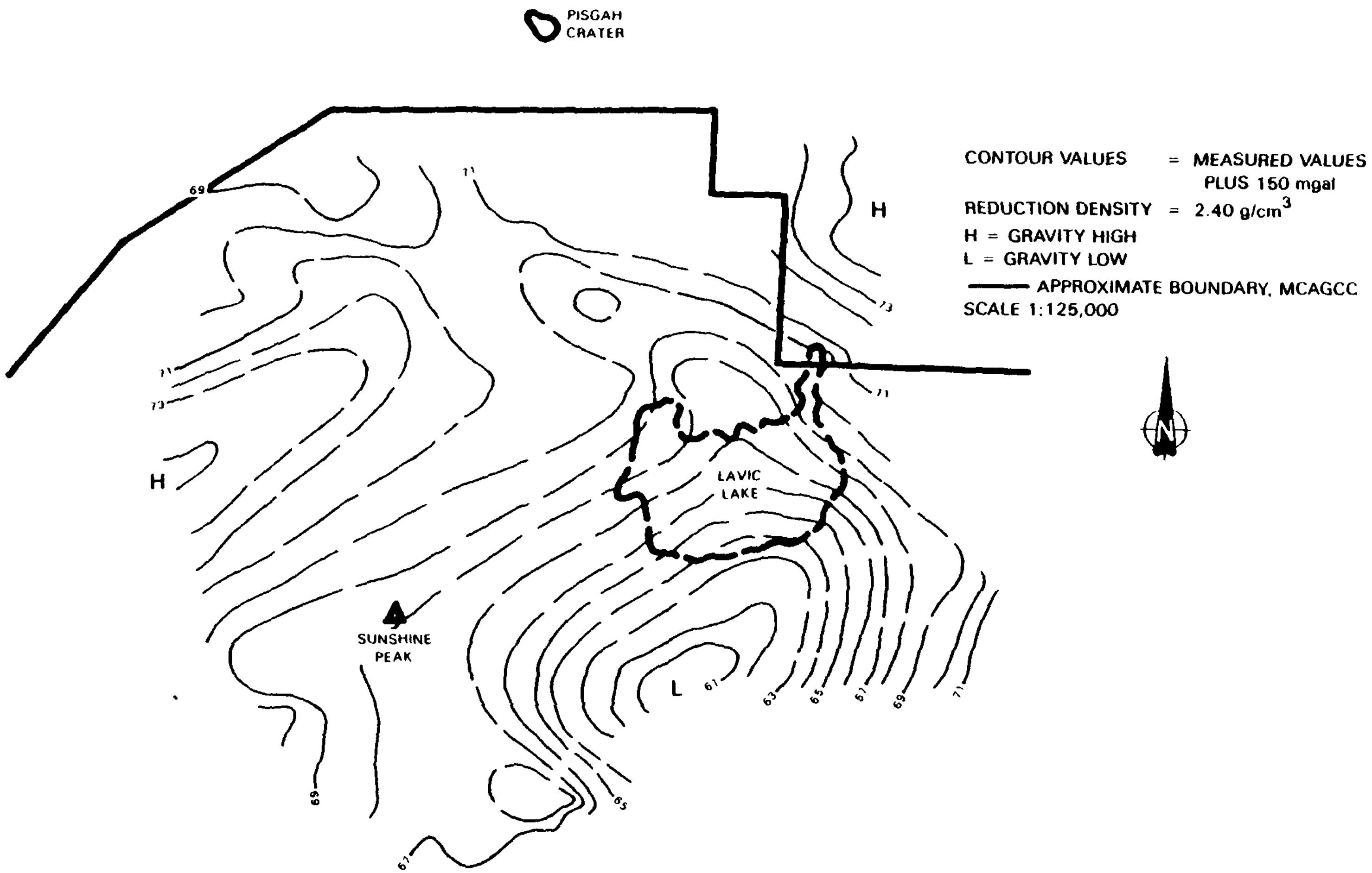

FIGURE 22. Complete Bouguer Gravity Map of the Lavic Lake Area. Contour interval is 1 mgal; contour values equal measured values plus 150 mgal. Reduction density is 2.40 g/cm^3.

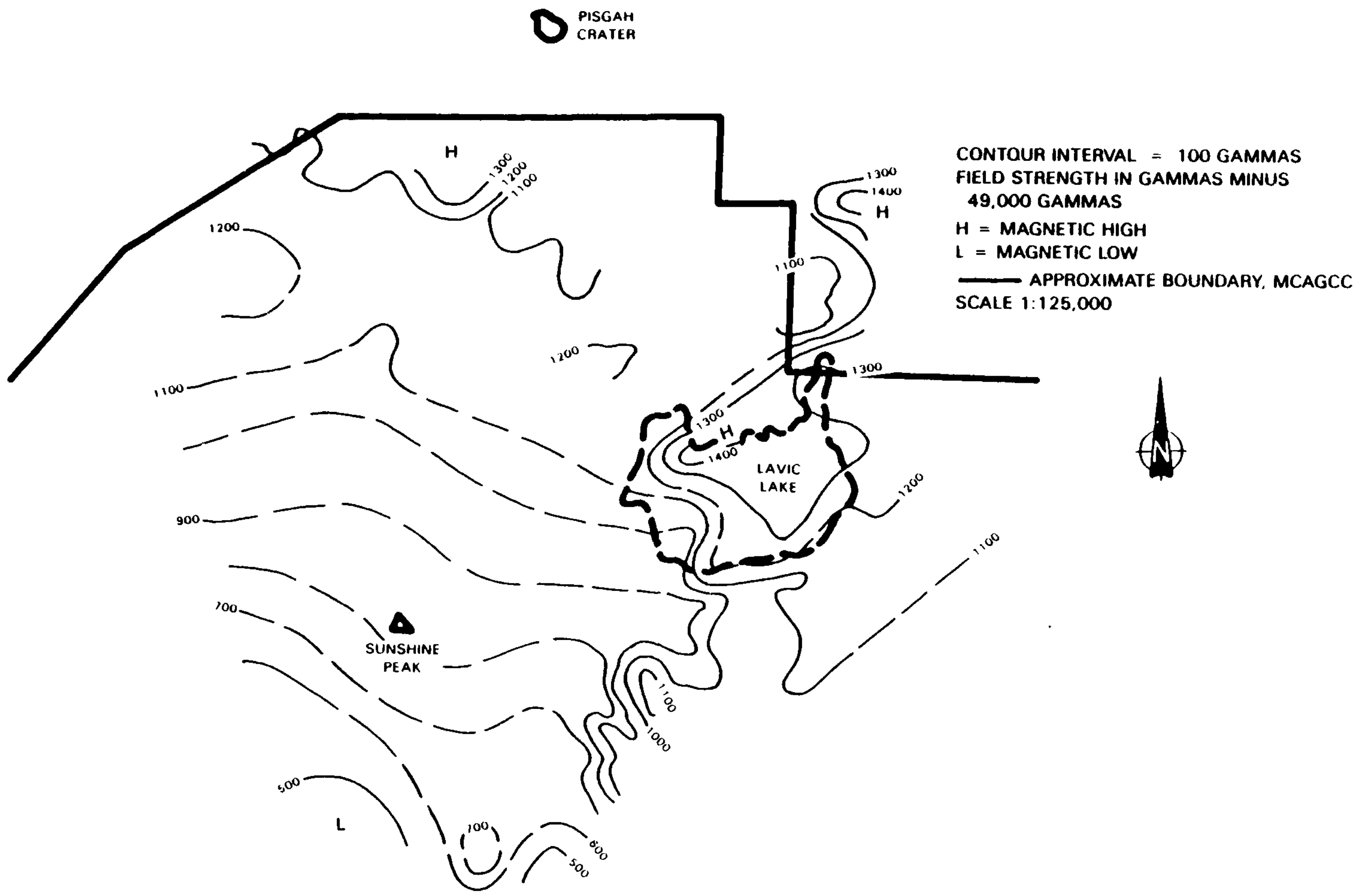

FIGURE 23. Total Intensity Ground-Magnetic Map of the Lavic Lake Area. Contour interval is 100 gammas; map values are measured values minus 49,000 gammas.

DISCUSSION

Evidence for the occurrence of a geothermal resource at or near Lavic Lake is based on few available data. A single chemical geothermometry point, calculated from analysis of waters taken from the Sunshine Mine well, indicates a resource temperature of between 90 and about 120°C. Gravity studies indicate that the area directly south of Lavic Lake gives the appearance of a large structural basin or collapsed volcanic feature. The site lies in close proximity to very recent basaltic craters (Pisgah, Amboy) that lie roughly in an east-west trend. This trend passes through the Lavic Lake area. If Pisgah Crater exists because of a weakness in the crust caused by the intersection of this east-west trend with the N40°W trend as defined by aeromagnetics, it is possible that residual heat of this recent volcanic action still exists at depth beneath the Lavic Lake area.

CONCLUSIONS AND RECOMMENDATIONS

MAIN CAMP/ADMINISTRATION AREA

The data strongly indicate that a geothermal resource is present at drillable depths approximately 8 miles WNW of the Main Camp/Administration Area of MCAGCC. This resource has a minimum temperature of 67°C (153°F) and encompasses at least 4500 acres of MCAGCC-controlled lands between the Surprise Spring and Mesquite Lake Faults. The data further indicate that this resource extends south toward the town of Twentynine Palms. This extension has been verified by both this study and a study by the URS Corporation (1985).

The limits and total-area extent of the geothermal resource are not known. Thermal-gradient drilling showed that the geothermal fluids present are not migrating north into MCAGCC along the West Bullion Mountain Fault from the Pinto Mountain Fault area. Geothermal fluids may be migrating north or south along both the Mesquite Lake Fault and the Surprise Spring Fault but the data in hand are not sufficient to reveal from which direction. The data enable us to define with reasonable confidence the southern extent of the geothermal resource, but the northern extent of the resource is undetermined.

The data suggest that the heat source of the known resource could lie within MCAGCC-controlled lands though outside the area that has been explored in detail for geothermal resources. It is possible that the near-surface characteristics of the geothermal resource delineated in the vicinity of the Surprise Spring Fault are actually leakage from adjacent hotter, deeper geothermal reservoirs. Examination of the gravity and magnetic data gathered reveals the presence of a large and deep sedimentary-filled structural basin centered immediately north of Deadman Lake. This same type structure elsewhere within the Basin and Range geologic province has provided the mechanism for large-scale geothermal convection cells to form, which elevate natural fluids to temperatures in excess of 150°C providing economically developable deposits.

The Geothermal Program Office makes the following recommendations for further delineation of the size, depth, and producibility of the resource near the Main Camp/Administration Area:

1. To obtain temperature data we suggest pumping out the water in the 2.5-inch black-iron pipe casing within the seven thermal-gradient holes, then knocking the bottom out of the empty casing. Removing the bottom of the casing will allow the former gradient holes to fill with natural groundwater, if present. After the groundwater has reached its natural level within the casing, water samples will be obtained for chemical analysis. This chemical analysis will allow the determination of the resource temperatures using conventional geothermometry and will allow modeling to be conducted to determine flow and mixing patterns in the potential reservoir.

2. A complete geologic reconnaissance should be carried out north of the known resource area including the West Bullion Mountains and Hidalgo Mountain. This study will be designed to locate and map alteration and mineralization patterns, and to collect additional water samples. The information gathered in this study will enable mapping of fluid movement and identification of geochemical processes that have occurred. This exploration process will identify the hydrothermal history of the area and provide an indication of the northern limit and the subsurface temperature of the geothermal resource in the Main Camp/Administration Area.

The results of the studies proposed in these conclusions will determine the need for any further geothermal exploration beyond that outlined in this report. If we are moderately successful in the proposed field work, the exploration effort will shift to the drilling of thermal-gradient holes for final verification of the resource quality. To expedite this drilling, the black-iron casing in Thermal-Gradient Holes No. 5 and No. 6 can be pulled and the holes deepened.

LAVIC LAKE

The presence of a possible high-grade geothermal resource in the vicinity of Lavic Lake is indicated by recent adjacent vulcanism (Pisgah Crater); moderately high temperatures derived from geothermometry (90°C+) using water from the Lavic Lake area; strong structural lineations shown by geophysical studies; and, most important, a localized geophysical signature that can be interpreted as a buried volcanic feature typical of some geothermal reservoirs.

Because there is no way to directly test subsurface temperatures in the Lavic Lake structure, we recommend drilling at least one deep thermal-gradient hole in the vicinity of Kenton Mill (Figure 21), immediately south of Lavic Lake but within the structure of interest. This hole will provide a temperature-depth profile for the area and will provide an opportunity to sample subsurface fluids known to be present.

We also recommend a further geologic reconnaissance of the Lava Bed Mountains–Sunshine Peak–Pisgah Crater region to identify in detail the alteration and mineralization patterns that may indicate the presence of a young, shallow, hydrothermal system beneath Lavic Lake.

We believe that these studies should be done soon, so that given the energy shortages now predicted by the utility industry for the mid- to late 1990s (assuming no oil crises sooner than that), the Marine Corps will be in a position to assess both energy-driven encroachment threats to the use of the range area and the potential for major cost savings for the Center itself.

Appendix A

TWENTYNINE PALMS GEOTHERMOMETRY 1917 to 1983

Figure A-1 shows the relationship of a township, section, and subdivision for locating well sites using the U.S. Geological Survey well-numbering system. Table A-1 presents geothermometry data from wells in the Twentynine Palms area from 1917 to 1983. The location of each well is presented in the format of the USGS well-numbering system.

The USGS well-numbering system used in California indicates the location of wells according to the rectangular system for the subdivision of public land. This rectangular system is based on divisions called townships, which are 36 square miles and are numbered according to their relationship to a base line and a meridian. In Figure A-1, the San Bernardino Base Line provides the north-south reference and the San Bernardino Meridian provides the east-west reference. For example, T.1N., R.5E. is one township north of the San Bernardino Base Line and is five townships east of the San Bernardino Meridian.

Well numbering follows the township-numbering system and uses further, more specific, designations. Figure A-1 shows the location of well number 1N/5E-29L1; the first numbers and letters designate the township (T.1N.) and the range (R.5E.); the third number gives the section (sec. 29); and the letter indicates the 40-acre subdivision of the section. The final digit is the serial number assigned to this particular well; the wells in each 40-acre subdivision are given serial numbers to identify them within that subdivision.

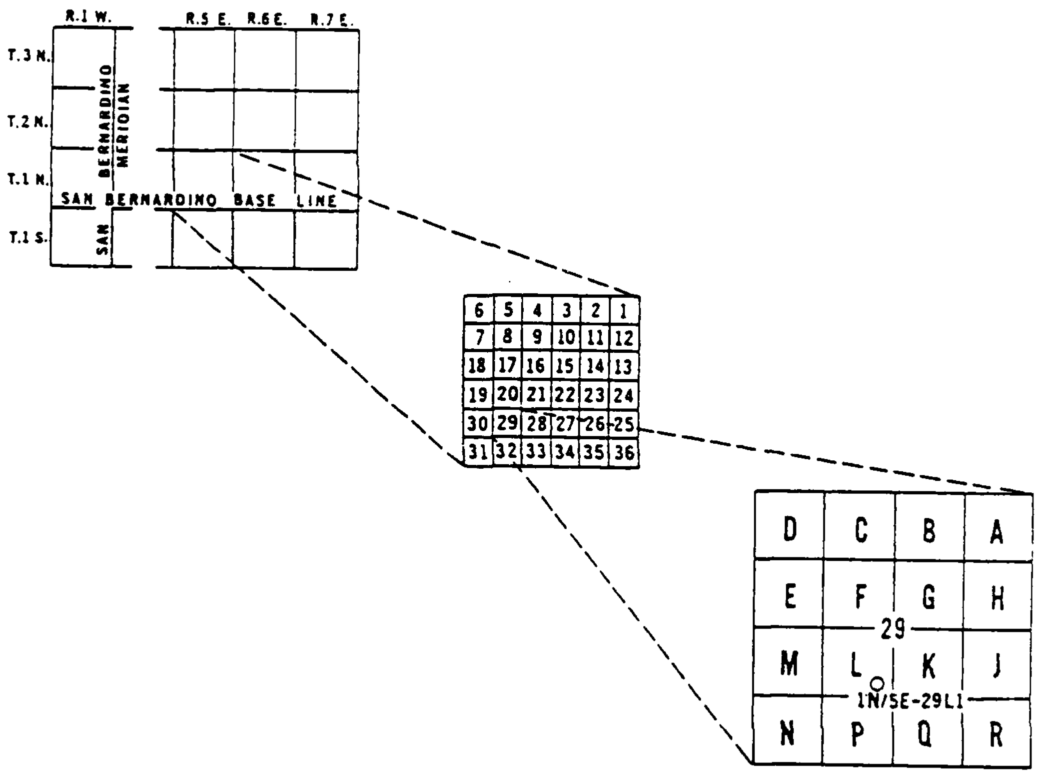

FIGURE A-1. Diagram Showing Relationship of Township, Section, and Subdivision for Locating Well Sites Using USGS Well-Numbering System.

TABLE A-1. Twentynine Palms Geothermometry 1917 to 1983.

All temperatures in °C unless otherwise noted.

Location	Date	Type of geothermometer						Measured temperature, °C/°F
		Quartz conductive cooling	Chalcedony conductive cooling	Quartz steam cooling	Na-K	Na-K-Ca	Na-K-Ca-Mg	
Data from Combs, 1973								
1N/9E-4N3	Not reported	...	...	...	100	59	...	18/64
1N/9E-5Q1	Not reported	...	...	...	119	71	...	...
2N/7E-2C1	04/21/52	68	27	65	...	..	...	34/93
	02/03/53	68	27	65	161	54	...	29/85
2N/7E-3A1	02/24/53	80	37	75	...	...	...	29/85
	05/04/54	...	...	...	160	54	...	28/82
	10/17/55	...	...	...	153	51	...	27/81
	05/14/58	...	...	...	163	55	...	27/80
	10/08/58	...	...	...	140	49	...	27/81
	04/07/59	...	...	...	156	53	...	27/81
	05/04/60	...	...	...	175	63	...	...
2N/7E-3B1	01/15/53	74	33	71	...	...	...	28/82
	02/24/53	78	37	74	...	...	...	28/82
	05/04/54	...	...	...	164	55	...	28/82
	12/21/54	...	...	...	164	56	...	...
	09/11/56	76	35	72	...	...	...	...
	10/08/58	...	...	...	152	53	...	28/82
	05/04/60	...	...	...	179	66	...	...
2N/7E-4H1	09/30/52	81	40	77	...	...	...	27/80
2N/7E-14K1	09/29/52	72	31	69	...	...	...	36/96
2N/8E-11B1	05/01/53	...	...	...	48	94	...	22/71
2N/8E-24H1	03/11/52	47	6	47	...	...	...	29/85
3N26E-4L1	12/05/51	68	27	65	...	...	...	...
3N/6E-4P1	01/29/53	...	...	...	165	48	...	...
3N,7E-13N1	08/08/52	80	39	75	...	...	...	28/83

TABLE A-1. (Contd.)

Location	Date	Type of geothermometer						Measured temperature, °C/°F
		Quartz conductive cooling	Chalcedony conductive cooling	Quartz steam cooling	Na-K	Na-K-Ca	Na-K-Ca-Mg	
Data from Combs, 1973 (Contd.)								
3N/7E-18D1	05/01/52	64	23	62	...	...	...	23/74
3N/7E-31E1	08/08/52	64	23	62	...	...	...	26/79
3N/7E-35P1	12/05/51	68	27	65	...	...	...	...
	05/01/53	...	...	...	203	86	...	...
3N/8E-17L1	03/18/52	64	23	62	...	...	...	28/83
3N/8E-29C1	06/12/52	68	23	62	...	...	...	29/85
3N/8E-29L1	12/01/52	68	23	62	105	74	...	26/79
	12/22/52	68	23	62	...	...	...	27/80
	05/05/54	...	...	...	101	70	...	26/79
	10/21/54	...	...	...	...	...	...	26/79
	04/16/55	...	...	...	106	72	...	26/79
	10/17/55	...	...	...	95	67	...	27/80
	04/04/56	30	-9	33	77	74	...	...
	09/11/56	72	31	69	...	...	...	...
	02/08/57	...	...	...	92	63	...	27/80
	05/14/58	...	...	...	105	74	...	27/80
	10/08/58	...	...	...	60	45	...	26/79
	05/04/60	...	...	...	135	92	...	...
3N/8E-33B1	Not reported	68	27	65	...	...	...	22/72
3N/8E-34D1	04/02/52	68	27	65	...	...	...	23/74
4N/6E-27C1	01/29/53	...	...	...	63	98	...	...
4N/6E-27D1	01/29/53	...	...	...	75	...	...	...
4N/6E-27F1	01/29/53	...	...	...	57	...	...	...
4N/6E-27M1	06/10/53	...	...	...	131	43	...	...

TABLE A-1. (Contd.)

Location	Date	Type of geothermometer						Measured temperature, °C/°F
		Quartz conductive cooling	Chalcedony conductive cooling	Quartz steam cooling	Na-K	Na-K-Ca	Na-K-Ca-Mg	
Data from Freckleton, 1982								
1N/9E-26E1	03/11/81	76	35	72	123	88	69	19/66 2
1N/9E-27C1	12/14/54	...	...	...	136	59	...	...
1N/9E-31A1	09/10/53	...	...	...	154	42	...	29/84 2
	02/26/54	...	...	...	135	37	...	22 2/72
	02/25/55	...	...	...	130	34	...	...
	05/07/56	...	...	...	140	38	...	26 1/79
	12/26/56	...	...	...	...	...	...	...
	06/19/57	89	48	83	127	32	...	...
	12/30/57	...	...	...	...	...	...	26 7/80
	07/10/58	...	...	...	...	...	...	28 9/84
	12/03/58	81	40	77	129	35	...	27 8/82
	06/02/60	...	...	...	...	...	...	...
	04/22/61	70	29	67	146	39	...	...
	11/10/64	...	...	...	124	31	...	77/25 0
	05/14/69	...	...	...	129	31	...	83/28 3
	05/08/75	...	...	...	169	49	...	21 1/70
	03/--/78	...	...	...	96	27	...	...
1N/9E-31A2	02/26/54	...	...	...	135	44	...	...
	02/25/55	...	...	...	120	32	...	...
	12/26/56	72	31	69	142	43	...	...
	07/10/58	80	37	75	120	29	...	...
	06/08/60	66	25	64	116	27	...	...
	12/28/64	70	29	67	127	39	...	...
	08/15/61	85	44	79	119	30	...	...
	05/30/62	81	40	77	119	27	...	...
	05/16/67	...	...	...	126	31	...	...
	05/14/69	...	...	...	134	26	...	...
	06/11/71	...	...	...	126	53	...	...

TABLE A-1. (Contd.)

Location	Date	Type of geothermometer						Measured temperature, °C/°F
		Quartz conductive cooling	Chalcedony conductive cooling	Quartz steam cooling	Na-K	Na-K-Ca	Na-K-Ca-Mg	
Data from Freckleton, 1982 (Contd.)								
1N/9E-31A2	02/24/72	...	...	...	148	47	...	...
	06/28/72	...	...	...	147	51	...	...
	11/09/72	...	...	...	141	50	...	...
	04/18/73	...	...	...	145	42	...	...
1N/9E-31C1	02/26/54	...	...	...	135	33	...	22 8/73
	02/25/55	...	...	...	135	29	...	...
	05/07/56	...	...	...	135	33	...	..
	12/26/56	...	...	...	...	...	...	22.2/72
	06/19/57	76	35	72	136	37	...	...
	12/17/57	83	42	78	151	38	...	26.7/80
	07/10/58	78	37	74	129	26	...	24.4/76
	06/02/60	66	25	64	126	25	...	...
1N/9E-31C1	11/10/64	...	...	...	119	30	...	25.0/77
	05/16/67	...	...	...	124	27	...	...
	05/08/75	...	...	...	168	44	...	21 1/70
	03/--/78	...	...	...	97	28	...	...
1N/9E-33F2	04/15/52	...	...	...	127	43	...	...
1N/9E-33F5	01/16/74	...	...	...	...	...	...	23 0/73 4
	03/11/81	...	...	...	...	...	...	22 0/71 6
1N/9E-33H1	01/15/74	...	...	...	...	...	...	22 5/72 5
	03/10/81	99	57	91	243	59	...	21 0/69 8
1N/9E-33H2	04/30/74	...	...	...	...	...	...	24 5/76 1
	03/10/81	...	...	...	...	...	...	22 0/71 6
1N/9E-33J2	03/10/81	18	21	22	194	108[a] 163[b]	21	23 0/73 4
1N/9E-33J3	03/10/81	...	..	...	...	..	...	23 0/73 4

[a] Na-K-Ca 4/3
[b] Na-K-Ca 1/3

TABLE A-1. (Contd.)

Location	Date	Type of geothermometer						Measured temperature, °C/°F
		Quartz conductive cooling	Chalcedony conductive cooling	Quartz steam cooling	Na-K	Na-K-Ca	Na-K-Ca-Mg	
Data from Freckleton, 1982 (Contd.)								
1N/9E-33J4	03/10/81	...	...	...	...	...	...	23 0/73 4
1N/9E-33J5	04/30/74	...	...	...	...	...	...	19 5/67.1
	03/10/81	...	...	...	...	...	...	18 0/64 4
1N/9E-33K1	03/10/81	...	...	...	...	...	...	23 0/73 4
1N/9E-33K2	12/04/73	...	...	...	...	...	...	22 5/72 5
	03/10/81	...	...	...	...	...	...	23 0/73 4
1N/9E-33K3	12/04/73	...	...	...	...	...	...	21.5/70.7
	03/10/81	...	...	...	...	...	...	22 5/72 5
1N/9E-33K4	03/10/81	59	18	57	262	74	...	23 0/73 4
1N/9E-33K5	12/04/73	...	...	...	...	...	...	20 0/68 0
	03/10/81	...	...	...	...	...	...	22 5/72 5
1N/9E-34A1	02/26/54	...	...	...	155	50	...	
	02/25/55	...	...	...	163	52	...	
	12/26/56	81	40	77	163	56	...	
	12/30/57	...	...	...	...	...	...	13 3/56
	07/10/58	85	44	79	152	44	...	25 6/78
1N/9E-35N1	05/07/56	...	...	...	163	59	...	
	12/26/56	66	25	64	146	59	...	24 4/76
	12/30/57	...	...	...	...	...	...	25 0/77
	Not reported	68	27	65	158	55	...	26 1/79
	12/03/58	64	23	62	149	62	...	25 6/78
	05/28/59	...	...	...	...	...	...	25 6/78
	08/15/61	74	33	71	151	38	...	
	11/10/64	...	...	...	156	61	...	25 0/77
	05/16/67	...	...	...	142	67	...	
	05/15/69	...	...	...	172	73	...	
	05/08/75	...	...	...	174	72	...	68/20 0
	03/--/78	...	...	...	118	47	...	25 8/78 5

TABLE A-1. (Contd.)

Location	Date	Type of geothermometer						Measured temperature, °C/°F
		Quartz conductive cooling	Chalcedony conductive cooling	Quartz steam cooling	Na-K	Na-K-Ca	Na-K-Ca-Mg	
Data from Freckleton, 1982 (Contd.)								
1S/9E-3D1	02/--/52	68	27	55	...	...	...	...
	04/15/52	...	...	...	152	51	...	15 6/60
1S-9E-3D1	11/24/53	...	...	...	152	56	...	...
	05/07/56	...	...	...	163	52	...	...
	12/26/56	66	25	64	166	53	...	23 9/75
	06/19/57	72	31	69	161	64	...	...
	12/30/57	...	...	...	...	...	...	20 6/69
	07/10/58	67	25	64	189	35	...	26.7/80
	12/03/58	64	23	62	150	59	...	...
	05/28/59	70	29	67	172	50	...	...
	06/28/60	...	...	...	...	...	...	27 2/81
	05/30/62	76	35	72	141	34	...	...
	05/08/75	...	...	...	153	48	...	21 1/70
	03/--/78	...	...	...	126	52	...	...
Data from Moyle, 1967								
4N/12E-6R1	04/23/45	...	...	...	136	224[a] 160[b]	...	...
5N/12E-5B1	05/19/54	...	...	...	104	106[a] 114[b]	...	...
	09/15/54	...	...	...	152	135[a] 150[b]	129	...
	05/23/55	...	...	...	105	103[a] 114[b]	...	...

[a] Na-K-Ca 4/3
[b] Na-K-Ca 1/3

TABLE A-1. (Contd.)

Location	Date	Type of geothermometer: Quartz conductive cooling	Chalcedony conductive cooling	Quartz steam cooling	Na-K	Na-K-Ca	Na-K-Ca-Mg	Measured temperature, °C/°F
Data from Moyle, 1967 (Contd.)								
5N/12E-5B1	05/14/57	72	31	69	106	104[a] 115[b]	...	...
	09/04/58	92	51	85	104	105[a] 115[b]	...	...
	05/13/61	81	40	77	106	92	...	...
	05/25/62	74	33	71	126	106[a] 127[b]	...	...
	05/13/64	68	27	65	105	108[a] 116[b]	...	...
5N/12E-11B1	05/10/54	...	...	...	120	93	74	...
	09/15/54	...	...	...	126	106[a] 127[b]	61	...
	05/23/55	...	...	...	111	98	81	...
	09/30/55	...	...	...	112	106[a] 119[b]	106	...
	05/25/56	...	...	...	...	...	...	26/79
	10/18/56	...	...	...	...	...	...	20/68
	05/14/56	...	...	...	...	...	...	25/77
	05/23/58	130	90	117	152	148[a] 153[b]	108	...
6N/6E-4G1	11/27/17	89	48	83	149	117[a] 138[b]	93	...
6N/11E-30G1	05/08/53	...	...	...	109	85	...	...
	05/08/83	...	...	...	107	82	...	...
6N/12E-29P1	12/30/54	...	...	...	104	75	...	...
	04/25/55	...	...	...	101	78	74	...

[a] Na-K-Ca 4/3
[b] Na-K-Ca 1/3

TABLE A-1. (Contd.)

Location	Date	Type of geothermometer						Measured temperature, °C/°F
		Quartz conductive cooling	Chalcedony conductive cooling	Quartz steam cooling	Na-K	Na-K-Ca	Na-K-Ca-Mg	
Data from Moyle, 1967 (Contd.)								
6N/12E-29P1	05/23/55	...	...	...	99	77	...	32/89
	09/30/55	...	...	...	...	...	...	28/82
	05/25/56	0	-38	6	91	79	...	30/86
	05/14/57	0	-38	6	93	97	...	30/86
	05/24/58	...	...	...	...	...	...	30/86
	05/17/59	11	-28	16	112	197[a]	...	32/89
						140[b]	...	
	05/17/60	...	...	...	...	...	...	32/89
6N/12E-32R1	07/13/57	100	59	92	111	174	...	28/83
6N/12E-35F1	01/09/55	76	35	72	...	...	...	...
	09/30/55	...	...	...	136	87	...	30/86
	10/18/56	81	40	77	120	90	...	30/86
	03/05/57	...	...	...	135	92	...	...
	05/14/57	81	40	77	131	88	...	29/84
	05/24/57	...	...	...	...	...	...	30/86
	09/04/58	...	...	...	...	...	...	32/89
	05/17/59	78	37	74	101	143	...	31/87
	09/10/59	...	...	...	...	...	...	30/86
	06/17/60	86	45	81	126	86	...	30/86
	05/13/61	...	...	...	...	...	...	29/85
	05/25/62	78	37	74	128	85	...	30/86
	05/20/63	56	15	55	133	95	...	29/85
	06/05/64	70	29	67	133	93	...	31/88
7N/11E-36K1	06/05/64	91	49	84	162	70	...	23/73

[a] Na-K-Ca 4/3
[b] Na-K-Ca 1/3

TABLE A-1. (Contd.)

Location	Date	Type of geothermometer						Measured temperature, °C/°F
		Quartz conductive cooling	Chalcedony conductive cooling	Quartz steam cooling	Na-K	Na-K-Ca	Na-K-Ca-Mg	
Data from Schaefer, 1978								
2N/7E-2D1	02/18/76	68	27	65	219	88	...	31.0/87.8
2N/7E-3A1	02/18/76	66	25	64	179	62	...	28.0/82.4
2N/7E-3B1	02/18/76	64	23	62	212	77	...	28.0/82.4
2N/7E-3E1	02/18/76	64	23	62	159	89	...	29.0/84.2
2N/7E-4H1	02/18/76	53	13	53	225	90	...	23.5/74.3
3N/7E-19A1[c]	02/19/76	46	6	47	169	90	...	24.0/75.2
3N/7E-19A1[d]	02/19/76	27	12	30	163	99	...	24.0/75.2
3N/7E-31E1	03/31/76	31	8	34	171	54	...	23.0/73.4
3N/7E-35P2	02/18/76	64	23	62	170	78	...	29.0/84.2
4N/6E-27D1	02/19/76	78	37	74	83	97	...	22.0/71.6
4N/6E-28R1	02/19/76	26	-13	29	131	36	...	21.5/70.7
4N/6E-34E1	02/19/76	30	9	33	151	32	...	20.0/68.0
3N/6E-4P2	02/19/76	56	15	55	254	71	...	22.0/71.6
4N/6E-32B1	03/02/76	64	23	62	178	50	...	22.0/71.6
3N/7E-36G1	01/16/68	74	33	71	101	70	...	23.5/74.3
3N/8E-29L1	02/18/76	64	23	62	113	76	...	23.0/73.4
1N/9E-4N3	05/04/54	...	...	...	112	66	...	25.0/77.0
1N/9E-5G1	03/15/67	12	27	16	99	59	...	18.5/65.3
Data from Bader and Moyle, 1960								
1N/5E-2N1	04/20/53	...	...	...	143	19	...	...
1N/9E-2D1	09/16/56	...	...	...	80	64	...	...
1N/5E-19B1	03/27/52	...	...	...	274	32	...	16/60
	02/25/54	...	...	...	217	14	...	15/59
	12/28/56	86	45	81	167	43	...	17/62

[c] Sample 600 feet below surface
[d] Sample 230 feet below surface

TABLE A-1. (Contd.)

Location	Date	Type of geothermometer						Measured temperature, °C/°F
		Quartz conductive cooling	Chalcedony conductive cooling	Quartz steam cooling	Na-K	Na-K-Ca	Na-K-Ca-Mg	
Data from Bader and Moyle, 1960 (Contd)								
1N/5E-22N1	02/10/53	...	...	...	150	18	...	18/64
1N/5E-34K1	02/25/54	...	...	...	206	20	...	15/59
	12/28/56	76	35	72	195	27	...	14/58
1N/5E-36H1	12/14/17	86	45	81	...	...	...	...
1N/6E-4Q1	09/11/53	...	...	...	135	93	...	28/82
1N/6E-6E1	05/31/53	...	...	...	119	68	...	21/70
1N/6E-10F1	09/11/53	...	...	...	185	56	...	...
1N/6E-13D1	05/05/54	...	...	...	135	49	...	...
	03/15/56	...	...	...	123	46	...	...
1N/6E-25M1	02/25/54	...	...	...	164	47	...	22/72
	12/27/56	80	39	75	175	44	...	23/74
1N/6E-26N1	04/01/57	...	...	...	185	18	...	15/59
1N/6E-29N1	11/23/53	...	...	...	57	...	...	...
	12/28/56	56	15	55	57	...	...	19/66
1N/6E-29N1	02/25/54	...	...	...	172	34	...	...
	12/28/56	76	35	72	147	28	...	20/68
1N/6E-31P1	01/23/53	...	...	...	178	45	...	...
1N/6E-35C1	Not reported	...	...	...	161	54	...	...
	03/25/54	...	...	...	155	54	...	...
	12/27/56	72	31	69	180	56	...	...
	12/27/51	96	55	89	184	57	...	21/70
1N/7E-10N1	02/25/54	...	...	...	151	37	...	...
	12/27/56	70	29	67	160	38	...	...
1N/7E-16P1	05/05/54	...	...	...	138	29	...	...
1N/7E-28R2	12/15/57	76	35	72	...	...	...	...
1N/7E-35D1	02/16/51	25	14	28	...	...	...	...
	02/25/54	...	...	...	175	43	...	...
1N/7E-35D1	12/30/57	101	60	93	196	50	...	...
1N/8E-1D1	12/30/57	...	...	...	110	66	...	...

TABLE A-1. (Contd.)

Location	Date	Type of geothermometer						Measured temperature, °C/°F
		Quartz conductive cooling	Chalcedony conductive cooling	Quartz steam cooling	Na-K	Na-K-Ca	Na-K-Ca-Mg	
Data from Bader and Moyle, 1960 (Contd.)								
1N/8E-9L1	03/--/52	59	18	57	...	...	...	24/76
	02/26/54	...	...	...	121	47	...	21/70
	12/27/56	64	23	62	133	51	...	...
1N/8E-12G1	04/15/52	...	...	...	72	62	...	...
	08/07/53	...	...	...	84	68	...	28/82
1N/8E-26G1	04/--/41	...	...	..	...	...	...	26/78
1N/8E-31K1	05/15/55	...	...	...	445?	73	...	...
	Not reported	...	...	...	...	45	...	...
1N/8E-36A1	04/--/41	...	...	...	...	...	...	23/74
	11/10/54	...	...	...	135	32	...	...
	05/07/56	...	...	...	123	26	...	...
	12/26/56	74	33	71	151	40	...	23/74
1N/9E-4N3	04/15/52	...	...	...	100	59	...	...
1N/9E-5Q1	04/--/41	...	...	...	...	...	...	21/70
1N/9E-7E1	02/25/55	...	...	...	105	59	...	...
1N/9E-8D2	01/03/55	...	...	...	96	62	...	...
1N/9E-8H2	02/25/55	...	...	...	97	60	...	...
1N/9E-8Q2	01/03/53	...	...	...	81	53	...	...
1N/9E-9F1	04/--/41	...	...	...	...	...	...	22/72
1N/9E-10D1	04/--/41	...	...	...	...	...	...	26/78
1N/9E-15G1	10/11/56	...	...	...	133	69	...	...
1N/9E-15N1	05/05/54	...	...	...	134	70	...	...
1N/9E-16G1	09/10/53	...	...	...	162	101[a]	...	23/74
		...	...	...		145[b]	...	
1N/9E-17E1	06/--/37	19	-21	22	...	...	...	...
1N/9E-17G1	07/01/57	...	...	...	112	70	...	...
1N/9E-17J6	11/19/54	...	...	...	112	55	...	...

[a] Na-K-Ca 4/3
[b] Na-K-Ca 1/3

TABLE A-1. (Contd.)

Location	Date	Type of geothermometer						Measured temperature, °C/°F
		Quartz conductive cooling	Chalcedony conductive cooling	Quartz steam cooling	Na-K	Na-K-Ca	Na-K-Ca-Mg	
Data from Bader and Moyle, 1960 (Contd.)								
1N/9E-19N3	06/30/57	...	...	...	70	56	...	...
1N/9E-20A1	02/26/54	...	...	...	107	59	...	...
	12/27/56	76	35	72	81	42	...	...
1N/9E-20R1	04/--/41	...	...	...	...	...	...	27/80
1N/9E-22B1	04/--/41	...	...	...	...	...	...	26/78
	07/18/52	...	...	...	114	131[a]	...	...
						127[b]	...	
1N/9E-22E1	04/--/41	...	...	...	...	...	...	22/72
1N/9E-26G1	08/03/55	...	...	...	66	86	...	...
1N/9E-27C1	12/14/54	...	...	...	136	59	...	...
1N/9E-29F1	04/--/41	...	...	...	...	...	...	48/118
1N/9E-29R1	04/--/41	...	...	...	...	...	...	24/76
1N/9E-31A1	09/19/53	...	...	...	154	42	...	29/85
	02/25/55	...	...	...	129	33	...	...
	06/19/52	89	48	83	127	32	...	...
1N/9E-31A2	02/26/54	...	...	...	135	44	...	...
1N/9E-31A2	12/26/56	72	31	69	142	46	...	...
1N/9E-31C1	02/26/54	...	...	...	135	33	...	23/73
	05/07/56	...	...	...	135	33	...	...
	12/17/57	83	41	78	151	38	...	27/80
1N/9E-33K2	04/15/52	...	...	...	127	43	...	...
1N/9E-33J1	12/16/17	88	47	81	...	...	...	...
1N/9E-34A1	02/26/54	...	...	...	155	50	...	...
	12/26/56	81	40	77	163	56	...	...
1N/9E-35N1	12/26/56	66	25	64	146	59	...	24/76
2N/5E-1H1	11/--/51	68	27	65	...	...	...	...
	02/25/53	...	...	...	163	38	...	...

[a] Na-K-Ca 4/3
[b] Na-K-Ca 1/3

TABLE A-1. (Contd.)

Location	Date	Type of geothermometer						Measured temperature, °C/°F
		Quartz conductive cooling	Chalcedony conductive cooling	Quartz steam cooling	Na-K	Na-K-Ca	Na-K-Ca-Mg	
Data from Bader and Moyle, 1960 (Contd.)								
2N/5E-1H1	03/11/55	...	...	...	153	39	...	...
	12/27/56	78	37	74	169	46	...	13/55
2N/6E-6D1	11/--/51	68	27	65	...	...	...	...
	12/27/56	68	27	65	160	49	...	...
2N/6E-7R1	01/29/53	...	...	...	175	38	...	...
	01/04/55	...	...	...	175	37	...	...
	03/11/55	...	...	...	177	37	...	...
4N/5E-13R1	11/01/53	...	...	...	102	69	...	22/72
1S/5E-2C3	02/25/54	...	...	...	161	25	...	...
	06/20/57	66	25	64	172	29	...	...
1S/5E-3B1	02/25/54	...	...	...	149	35	...	...
1S/5E-5A1	01/24/57	..	...	...	148	9	...	...
1S/7E-34F1	04/16/52	...	...	...	202	38	...	16/60
1S/9E-3D1	04/--/41	...	...	...	...	...	...	26/78
	02/--/52	68	27	65	...	...	...	...
	04/15/52	...	...	...	152	51	...	16/60
	11/24/53	...	...	...	152	56	...	...
	05/07/56	...	...	...	163	52	...	...
USGS Informal Computer Listing								
1N/8E-11R1	Not reported	117	76	106	108	88	...	152/66 7
1N/8E-13B1	Not reported	61	20	60	106	66	...	104/40
1N/8E-2N1	Not reported	117	76	106	91	75	...	127/53
1N/9E-14C1	Not reported	106	64	97	135	114	...	145/63
2N/7E-3B1	Not reported	68	27	65	183	62	...	79 7/26 5

Appendix B

PRINCIPAL GRAVITY AND MAGNETIC DATA, MAIN CAMP/ADMINISTRATION AREA

Table B-1 presents the principal gravity and magnetic data gathered from the Main Camp/Administration Area at MCAGCC, Twentynine Palms. Total amounts listed under the terrain correction heading may not equal the sum of the inner zone and outer zone terrain corrections because of rounding.

TABLE B-1. Principal Gravity and Magnetic Data, Main Camp/Administration Area.

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
1	34 15.95	116 10.57	2221.98	979441.53	0.14	0.00	0.15	-76.9	-95.9	-88.2	50175.0
2	34 15.93	116 10.77	2245.80	979440.26	0.14	0.00	0.15	-76.6	-95.7	-88.0	50182.0
3	34 16.10	116 10.70	2229.20	979441.30	0.15	0.00	0.15	-76.9	-95.9	-88.2	50181.0
4	34 16.27	116 10.67	2212.30	979442.41	0.15	0.00	0.15	-77.2	-96.0	-88.4	50157.0
5	34 16.43	116 10.65	2196.51	979443.49	0.15	0.00	0.15	-77.4	-96.1	-88.6	50138.0
6	34 16.60	116 10.63	2180.03	979444.50	0.15	0.00	0.16	-77.7	-96.3	-88.8	50121.0
7	34 16.73	116 10.52	2151.04	979446.47	0.15	0.00	0.16	-77.9	-96.3	-88.9	50120.0
8	34 16.85	116 10.37	2133.56	979447.75	0.15	0.00	0.15	-78.0	-96.2	-88.9	50109.0
9	34 16.97	116 10.22	2127.33	979447.83	0.15	0.00	0.15	-78.5	-96.7	-89.4	50125.0
10	34 17.08	116 10.07	2135.89	979447.05	0.16	0.00	0.16	-78.9	-97.1	-89.8	50128.0
11	34 17.17	116 10.00	2138.07	979446.86	0.17	0.00	0.18	-79.0	-97.3	-89.9	50090.0
12	34 17.23	116 10.17	2138.57	979447.00	0.16	0.00	0.16	-79.0	-97.2	-89.9	50108.0
13	34 17.40	116 10.25	2125.47	979447.95	0.17	0.00	0.17	-79.1	-97.3	-89.9	50062.0
14	34 17.57	116 10.32	2107.21	979449.03	0.20	0.00	0.20	-79.5	-97.5	-90.2	50042.0
15	34 17.67	116 10.48	2068.72	979451.96	0.19	0.00	0.19	-79.4	-97.0	-89.9	50012.0
16	34 17.67	116 10.55	2058.65	979452.93	0.18	0.00	0.19	-79.1	-96.6	-89.6	50022.0
17	34 16.53	116 10.77	2205.76	979443.05	0.15	0.00	0.16	-77.3	-96.2	-88.6	50157.0
18	34 16.42	116 10.92	2234.43	979441.45	0.15	0.00	0.15	-76.8	-95.9	-88.2	50175.0
19	34 16.30	116 11.07	2263.49	979439.85	0.15	0.00	0.15	-76.2	-95.6	-87.8	50188.0
20	34 16.18	116 11.22	2295.94	979437.74	0.17	0.00	0.18	-75.9	-95.5	-87.6	50228.0
21	34 16.08	116 11.37	2319.13	979436.31	0.15	0.00	0.15	-75.7	-95.5	-87.5	50222.0
22	34 15.95	116 11.50	2346.48	979434.65	0.15	0.00	0.16	-75.3	-95.3	-87.2	50229.0
23	34 15.85	116 11.67	2372.12	979433.37	0.15	0.00	0.15	-74.6	-94.9	-86.7	50199.0
24	34 15.73	116 11.80	2394.13	979432.58	0.15	0.00	0.15	-73.8	-94.2	-86.0	50227.0
25	34 15.62	116 11.95	2409.07	979431.76	0.15	0.00	0.15	-73.4	-94.0	-85.7	50268.0
26	34 15.48	116 12.10	2420.86	979431.09	0.16	0.00	0.17	-73.1	-93.7	-85.4	50207.0

See footnotes at end of table

TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
27	34 15.38	116 12.25	2456.19	979429.15	0.20	0.00	0.20	-72.4	-93.4	-84.9	50336.0
28	34 15.25	116 12.42	2543.51	979423.04	0.25	0.00	0.25	-72.3	-94.0	-85.2	50378.0
29	34 15.15	116 12.53	2602.64	979418.88	0.26	0.00	0.27	-72.3	-94.4	-85.5	50395.0
30	34 15.07	116 12.65	2597.21	979419.49	0.19	0.00	0.20	-72.0	-94.1	-85.2	...
31	34 15.18	116 12.82	2582.71	979420.93	0.17	0.00	0.18	-71.7	-93.7	-84.9	50447.0
32	34 15.32	116 12.95	2543.71	979424.14	0.14	0.00	0.15	-71.4	-93.1	-84.3	50422.0
33	34 15.43	116 13.07	2540.55	979424.78	0.16	0.00	0.16	-71.1	-92.8	-84.1	50420.0
34	34 15.55	116 13.20	2583.74	979421.95	0.16	0.00	0.16	-71.1	-93.2	-84.3	50377.0
35	34 15.65	116 13.37	2608.41	979420.47	0.17	0.00	0.17	-71.1	-93.3	-84.4	50372.0
36	34 15.72	116 13.55	2612.49	979420.33	0.15	0.00	0.16	-71.0	-93.3	-84.3	50360.0
37	34 15.83	116 13.67	2596.19	979421.49	0.15	0.00	0.16	-71.2	-93.3	-84.4	50324.0
38	34 16.00	116 13.90	2597.69	979421.49	0.15	0.00	0.15	-71.3	-93.5	-84.5	50359.0
39	34 16.12	116 14.08	2592.53	979421.93	0.14	0.00	0.14	-71.4	-93.3	-84.6	50382.0
40	34 16.23	116 14.23	2584.51	979422.57	0.15	0.00	0.15	-71.4	-93.5	-84.6	50348.0
41	34 16.35	116 14.38	2576.64	979423.15	0.15	0.00	0.15	-71.6	-93.6	-84.7	50304.0
42	34 16.47	116 14.52	2563.73	979424.07	0.15	0.00	0.15	-71.7	-93.6	-84.8	50250.0
43	34 16.58	116 14.58	2578.88	979422.93	0.16	0.00	0.16	-71.9	-94.0	-85.1	50231.0
44	34 16.72	116 14.72	2574.79	979423.20	0.15	0.00	0.15	-72.2	-94.1	-85.3	50216.0
45	34 16.83	116 14.75	2558.25	979424.35	0.15	0.00	0.15	-72.3	-94.1	-85.3	50204.0
46	34 16.87	116 14.57	2527.90	979426.24	0.16	0.00	0.16	-72.5	-94.1	-85.4	50148.0
47	34 16.98	116 14.43	2479.10	979429.48	0.16	0.00	0.17	-72.8	-94.0	-85.4	50145.0
48	34 17.10	116 14.28	2466.64	979430.09	0.16	0.00	0.17	-73.2	-94.2	-85.8	50140.0
49	34 17.20	116 14.12	2424.00	979432.86	0.18	0.00	0.19	-73.5	-94.1	-85.8	50132.0
50	34 17.32	116 13.97	2374.65	979436.21	0.20	0.00	0.21	-73.6	-93.9	-85.7	50157.0
51	34 17.42	116 13.80	2331.11	979439.18	0.21	0.00	0.21	-73.8	-93.7	-85.6	50164.0
52	34 17.53	116 13.65	2288.08	979442.29	0.22	0.00	0.23	-73.8	-93.3	-85.4	50325.0
53	34 17.65	116 13.52	2280.37	979443.32	0.19	0.00	0.19	-73.5	-92.9	-85.1	50337.0
54	34 17.77	116 13.40	2261.39	979445.11	0.20	0.00	0.21	-73.1	-92.4	-84.6	50338.0
55	34 17.88	116 13.28	2248.99	979446.58	0.21	0.00	0.21	-72.7	-91.8	-84.1	50338.0

See footnotes at end of table

TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
56	34 17.98	116 13.17	2232.62	979447.83	0.22	0.00	0.22	-72.7	-91.7	-84.0	50417.0
57	34 18.13	116 13.07	2310.50	979442.30	0.29	0.00	0.29	-73.0	-92.7	-84.7	50307.0
58	34 18.25	116 13.22	2319.06	979442.60	0.22	0.00	0.22	-72.4	-92.1	-84.2	50349.0
59	34 18.37	116 13.35	2332.94	979442.61	0.21	0.00	0.21	-71.6	-91.5	-83.5	50394.0
60	34 18.00	116 12.95	2263.89	979445.08	0.22	0.00	0.23	-73.3	-92.6	-84.8	50287.0
61	34 17.87	116 12.85	2187.86	979449.97	0.21	0.00	0.21	-73.4	-92.1	-84.6	50342.0
62	34 17.72	116 12.75	2189.24	979449.19	0.21	0.00	0.21	-73.9	-92.6	-85.1	50311.0
63	34 17.67	116 12.63	2212.95	979447.05	0.20	0.00	0.20	-74.4	-93.3	-85.7	50250.0
64	34 17.85	116 12.67	2161.50	979450.97	0.22	0.00	0.22	-74.2	-92.6	-85.2	50241.0
65	34 17.92	116 12.47	2140.30	979451.61	0.23	0.00	0.23	-75.1	-93.3	-86.0	50174.0
66	34 17.98	116 12.28	2119.96	979452.13	0.23	0.00	0.24	-76.1	-94.1	-86.9	50112.0
67	34 18.05	116 12.12	2121.15	979451.19	0.21	0.00	0.21	-77.1	-95.1	-87.9	50088.0
68	34 18.12	116 11.83	2112.78	979450.64	0.20	0.00	0.20	-78.3	-96.3	-89.0	50114.0
69	34 18.10	116 11.63	2104.56	979450.80	0.19	0.00	0.20	-78.7	-96.6	-89.4	50082.0
70	34 18.07	116 11.43	2090.33	979451.33	0.19	0.00	0.19	-79.1	-96.9	-89.7	50076.0
71	34 18.05	116 11.23	2071.33	979452.25	0.19	0.00	0.20	-79.4	-97.1	-90.0	50040.0
72	34 18.05	116 11.03	2046.49	979453.61	0.20	0.00	0.20	-79.8	-97.2	-90.2	50008.0
73	34 18.03	116 10.82	2028.87	979454.58	0.20	0.00	0.21	-80.0	-97.3	-90.3	49985.0
74	34 18.02	116 10.63	2017.89	979455.15	0.20	0.00	0.20	-80.1	-97.3	-90.4	49981.0
75	34 17.88	116 10.58	2034.92	979454.21	0.22	0.00	0.22	-79.7	-97.0	-90.0	50000.0
76	34 17.48	116 12.63	2279.03	979442.13	0.18	0.00	0.18	-74.5	-94.0	-86.1	50218.0
77	34 17.30	116 12.63	2318.67	979439.14	0.17	0.00	0.18	-74.6	-94.3	-86.4	50284.0
78	34 17.13	116 12.65	2345.47	979437.13	0.17	0.00	0.17	-74.5	-94.5	-86.5	50291.0
79	34 17.02	116 12.65	2360.26	979436.10	0.16	0.00	0.16	-74.4	-94.5	-86.4	50281.0
80	34 16.77	116 12.65	2393.87	979433.82	0.17	0.00	0.18	-74.0	-94.4	-86.2	50291.0
81	34 16.62	116 12.65	2375.14	979435.61	0.16	0.00	0.16	-73.3	-93.5	-85.4	50272.0
82	34 16.45	116 12.65	2372.68	979435.80	0.17	0.00	0.17	-73.0	-93.2	-85.1	50228.0
83	34 16.28	116 12.65	2392.55	979434.48	0.18	0.00	0.18	-72.7	-93.1	-84.9	50240.0
84	34 16.08	116 12.65	2417.20	979433.05	0.18	0.00	0.18	-72.2	-92.8	-84.5	50232.0

See footnotes at end of table

TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
85	34 15.93	116 12.65	2445.28	979431.37	0.18	0.00	0.18	-71.7	-92.6	-84.2	50279.0
86	34 15.73	116 12.65	2494.96	979427.84	0.16	0.00	0.16	-71.6	-92.9	-84.3	50386.0
87	34 15.57	116 12.65	2486.19	979428.23	0.16	0.00	0.16	-71.6	-92.8	-84.2	50405.0
88	34 15.35	116 12.65	2557.17	979422.71	0.19	0.00	0.20	-71.9	-93.7	-84.9	50438.0
89	34 15.08	116 12.35	2553.50	979421.95	0.21	0.00	0.21	-72.5	-94.3	-85.5	50367.0
90	34 15.07	116 12.17	2510.23	979424.72	0.21	0.00	0.21	-72.7	-94.1	-85.5	50398.0
91	34 15.05	116 11.97	2448.19	979428.68	0.18	0.00	0.19	-73.0	-93.9	-85.5	50412.0
92	34 15.07	116 11.75	2416.87	979430.63	0.15	0.00	0.16	-73.2	-93.8	-85.5	50460.0
93	34 15.07	116 11.58	2381.61	979433.19	0.16	0.01	0.16	-73.1	-93.4	-85.2	50427.0
94	34 15.08	116 11.38	2386.07	979432.72	0.15	0.00	0.15	-73.3	-93.6	-85.4	50326.0
95	34 15.08	116 11.20	2388.41	979432.45	0.16	0.00	0.16	-73.4	-93.8	-85.5	50309.0
96	34 15.08	116 10.98	2353.50	979434.67	0.16	0.00	0.16	-73.6	-93.6	-85.5	50273.0
97	34 15.08	116 10.77	2318.87	979436.62	0.16	0.01	0.16	-74.0	-93.8	-85.8	50236.0
98	34 15.08	116 10.57	2284.92	979438.50	0.16	0.01	0.16	-74.4	-93.9	-86.1	50191.0
99	34 15.08	116 10.35	2248.26	979440.33	0.15	0.01	0.16	-75.1	-94.3	-86.6	50179.0
100	34 15.10	116 10.15	2240.74	979440.37	0.14	0.01	0.14	-75.6	-94.7	-87.0	50212.0
101	34 15.10	116 9.95	2260.37	979438.66	0.12	0.01	0.12	-76.0	-95.3	-87.5	50241.0
102	34 15.10	116 9.77	2258.06	979438.75	0.12	0.01	0.13	-76.1	-95.3	-87.6	50232.0
103	34 15.08	116 9.52	2243.16	979439.61	0.13	0.01	0.13	-76.2	-95.4	-87.6	...
104	34 15.10	116 9.30	2229.57	979440.35	0.12	0.01	0.13	-76.4	-95.4	-87.8	50198.0
105	34 15.10	116 9.10	2212.53	979441.24	0.13	0.01	0.14	-76.7	-95.6	-88.0	50174.0
106	34 15.15	116 8.92	2193.11	979442.23	0.13	0.01	0.14	-77.1	-95.8	-88.3	50165.0
107	34 15.28	116 8.77	2175.17	979443.14	0.13	0.01	0.14	-77.6	-96.2	-88.7	50133.0
108	34 15.42	116 8.63	2157.93	979444.17	0.14	0.01	0.14	-77.9	-96.3	-88.9	50105.0
109	34 15.53	116 8.48	2138.74	979445.42	0.14	0.01	0.15	-78.2	-96.4	-89.1	50094.0
110	34 15.65	116 8.35	2119.75	979446.18	0.15	0.01	0.16	-78.9	-96.9	-89.7	50127.0
111	34 15.80	116 8.30	2103.19	979435.71	0.14	0.01	0.15	-90.7	-108.6	-101.4	...
112	34 15.97	116 8.40	2093.33	979448.13	0.17	0.01	0.17	-79.1	-97.0	-89.8	50097.0
113	34 16.10	116 8.50	2080.33	979449.18	0.16	0.00	0.16	-79.2	-96.9	-89.8	50085.0

See footnotes at end of table

TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
114	34 16.27	116 8.57	2075.47	979449.57	0.17	0.01	0.17	-79.3	-97.0	-89.9	50081.0
115	34 16.38	116 8.65	2066.25	979450.40	0.17	0.01	0.18	-79.3	-96.9	-89.8	50058.0
116	34 16.55	116 8.72	2068.43	979450.38	0.17	0.01	0.18	-79.4	-97.0	-89.9	50042.0
117	34 16.68	116 8.80	2069.71	979450.49	0.17	0.00	0.17	-79.4	-97.1	-89.9	50054.0
118	34 16.77	116 8.97	2067.51	979450.78	0.17	0.00	0.17	-79.4	-97.0	-89.9	50050.0
119	34 16.83	116 9.00	2062.74	979451.18	0.17	0.00	0.17	-79.4	-97.0	-89.9	50045.0
120	34 16.90	116 9.18	2062.13	979451.32	0.17	0.00	0.17	-79.4	-97.0	-89.9	50044.0
121	34 16.98	116 9.37	2071.87	979450.87	0.16	0.00	0.17	-79.3	-97.0	-89.8	50021.0
122	34 17.02	116 9.55	2079.72	979450.39	0.17	0.00	0.17	-79.3	-97.0	-89.9	50034.0
123	34 17.13	116 9.68	2102.95	979448.90	0.18	0.00	0.18	-79.4	-97.3	-90.1	50022.0
124	34 17.15	116 9.87	2127.80	979447.33	0.18	0.00	0.18	-79.2	-97.4	-90.1	50069.0
125	34 16.32	116 11.15	2273.90	979439.32	0.15	0.00	0.16	-76.1	-95.5	-87.7	50193.0
126	34 16.50	116 11.17	2260.54	979440.47	0.15	0.00	0.16	-76.1	-95.4	-87.6	50179.0
127	34 16.65	116 11.17	2246.11	979441.44	0.16	0.00	0.16	-76.3	-95.5	-87.8	50161.0
128	34 16.80	116 11.18	2233.22	979442.22	0.16	0.00	0.16	-76.7	-95.7	-88.0	50153.0
129	34 16.97	116 11.18	2214.04	979443.43	0.16	0.00	0.16	-77.0	-95.9	-88.3	50117.0
130	34 17.13	116 11.22	2195.80	979444.54	0.16	0.00	0.17	-77.4	-96.1	-88.5	50115.0
131	34 17.30	116 11.25	2176.96	979445.77	0.17	0.00	0.17	-77.7	-96.2	-88.7	50125.0
132	34 17.47	116 11.25	2155.24	979447.16	0.18	0.00	0.18	-78.0	-96.4	-88.9	50102.0
133	34 17.60	116 11.25	2140.96	979448.00	0.18	0.00	0.18	-78.3	-96.6	-89.2	50097.0
134	34 17.78	116 11.25	2113.41	979449.72	0.18	0.00	0.19	-78.7	-96.7	-89.5	50080.0
135	34 17.67	116 11.45	2153.10	979447.46	0.18	0.00	0.18	-78.1	-96.5	-89.1	50098.0
136	34 17.67	116 11.58	2168.83	979446.74	0.18	0.00	0.18	-77.7	-96.2	-88.8	50106.0
137	34 17.67	116 11.78	2187.40	979445.90	0.18	0.00	0.18	-77.3	-96.0	-88.4	50106.0
138	34 17.67	116 11.98	2208.16	979445.11	0.18	0.00	0.18	-76.7	-95.5	-87.9	50130.0
139	34 17.67	116 12.20	2222.13	979444.80	0.19	0.00	0.19	-76.0	-95.0	-87.3	50148.0
140	34 17.67	116 12.33	2243.85	979443.85	0.20	0.00	0.20	-75.5	-94.6	-86.9	50177.0
141	34 17.67	116 12.50	2236.66	979444.96	0.19	0.00	0.19	-74.9	-93.9	-86.3	50239.0
142	34 16.63	116 12.83	2393.80	979434.53	0.17	0.00	0.18	-73.1	-93.5	-85.3	50230.0

See footnotes at end of table

TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
143	34 16.70	116 13.02	2409.68	979433.44	0.17	0.00	0.17	−73.2	−93.7	−85.5	50222.0
144	34 16.73	116 13.17	2408.37	979433.56	0.18	0.00	0.19	−73.2	−93.7	−85.5	50225.0
145	34 16.80	116 13.37	2400.37	979434.09	0.19	0.00	0.19	−73.3	−93.8	−85.5	50155.0
146	34 16.85	116 13.52	2423.18	979432.57	0.22	0.00	0.22	−73.3	−93.9	−85.6	50148.0
147	34 17.00	116 13.62	2400.32	979434.13	0.21	0.00	0.21	−73.5	−94.0	−85.7	50150.0
148	34 17.12	116 13.78	2387.26	979435.02	0.22	0.00	0.22	−73.7	−94.0	−85.8	50157.0
149	34 17.20	116 13.95	2394.77	979434.64	0.20	0.00	0.20	−73.7	−94.1	−85.9	50170.0
150	34 17.32	116 13.97	2432.84	979431.76	0.18	0.00	0.18	−74.1	−94.9	−86.5	50134.0
151	34 16.40	116 13.18	2456.40	979430.53	0.17	0.00	0.18	−72.5	−93.4	−85.0	50232.0
152	34 16.22	116 13.18	2480.11	979429.04	0.18	0.00	0.18	−72.1	−93.2	−84.7	50250.0
153	34 16.05	116 13.20	2515.46	979426.70	0.18	0.00	0.19	−71.8	−93.2	−84.6	50297.0
154	34 15.90	116 13.22	2557.32	979423.75	0.19	0.00	0.19	−71.6	−93.4	−84.6	50282.0
155	34 15.82	116 13.38	2589.78	979421.63	0.17	0.00	0.18	−71.4	−93.5	−84.6	50326.0
156	34 16.48	116 12.50	2364.49	979435.93	0.16	0.00	0.16	−73.5	−93.7	−85.5	50222.0
157	34 16.42	116 12.32	2378.04	979433.94	0.17	0.00	0.17	−74.5	−94.7	−86.6	50198.0
158	34 16.30	116 12.17	2387.07	979433.08	0.17	0.00	0.17	−74.5	−94.9	−86.7	50197.0
159	34 16.17	116 12.05	2380.54	979432.35	0.17	0.00	0.17	−75.5	−95.8	−87.7	50198.0
160	34 16.07	116 11.90	2360.76	979433.31	0.16	0.00	0.16	−75.8	−95.9	−87.8	50207.0
161	34 16.00	116 11.70	2360.76	979433.99	0.15	0.00	0.15	−75.0	−95.2	−87.0	50217.0
162	34 16.78	116 12.45	236[illegible].55	979434.87	0.16	0.00	0.16	−74.8	−95.0	−86.8	50256.0
163	34 16.75	116 12.25	2343.70	979436.41	0.15	0.00	0.16	−74.8	−94.8	−86.8	50373.0
164	34 16.73	116 12.05	2317.07	979438.20	0.16	0.00	0.16	−74.8	−94.6	−86.6	50262.0
165	34 16.78	116 11.83	2298.00	979439.29	0.15	0.00	0.15	−75.1	−94.7	−86.8	50229.0
166	34 16.77	116 11.63	2286.95	979439.70	0.16	0.00	0.16	−75.4	−95.0	−87.1	50234.0
167	34 16.78	116 11.38	2255.92	979441.31	0.15	0.00	0.15	−76.0	−95.2	−87.5	50200.0
168	34 16.77	116 11.18	2237.44	979441.98	0.15	0.00	0.16	−76.6	−95.6	−88.0	50164.0
169	34 16.75	116 10.98	2212.67	979443.09	0.16	0.00	0.16	−77.1	−96.0	−88.4	50145.0
170	34 16.72	116 10.78	2185.16	979444.65	0.17	0.00	0.17	−77.4	−96.0	−88.5	50129.0
171	34 15.90	116 10.40	2206.55	979442.48	0.14	0.00	0.14	−77.0	−95.8	−88.2	50175.0

See footnotes at end of table

TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
172	34 15.87	116 10.20	2185.77	979443.72	0.14	0.01	0.14	-77.1	-95.8	-88.2	50144.0
173	34 15.87	116 10.00	2186.35	979443.58	0.13	0.01	0.13	-77.2	-95.9	-88.3	50137.0
174	34 15.87	116 9.80	2215.40	979441.28	0.13	0.00	0.14	-77.5	-96.4	-88.8	50144.0
175	34 15.85	116 9.57	2206.17	979441.85	0.12	0.01	0.13	-77.6	-96.4	-88.8	50133.0
176	34 15.85	116 9.37	2192.51	979442.53	0.13	0.01	0.13	-77.8	-96.5	-89.0	50130.0
177	34 15.87	116 9.17	2182.05	979443.07	0.14	0.01	0.14	-78.0	-96.6	-89.1	50126.0
178	34 15.88	116 8.97	2166.24	979443.89	0.14	0.01	0.15	-78.3	-96.8	-89.3	50108.0
179	34 15.88	116 8.77	2139.55	979445.49	0.15	0.01	0.16	-78.5	-96.8	-89.4	50085.0
180	34 15.90	116 8.58	2110.52	979447.31	0.15	0.01	0.15	-78.7	-96.7	-89.5	50106.0
181	34 15.27	116 10.23	2225.89	979441.34	0.14	0.01	0.15	-75.9	-94.9	-87.2	50187.0
182	34 15.40	116 10.30	2223.63	979441.39	0.14	0.01	0.14	-76.2	-95.2	-87.5	50176.0
183	34 15.57	116 10.22	2207.71	979442.32	0.13	0.00	0.14	-76.6	-95.4	-87.8	50171.0
184	34 15.75	116 10.23	2198.39	979442.93	0.14	0.01	0.15	-76.9	-95.6	-88.1	50162.0
185	34 16.03	116 10.22	2179.23	979444.31	0.14	0.01	0.14	-77.2	-95.8	-88.3	50137.0
186	34 16.20	116 10.23	2167.58	979445.08	0.14	0.00	0.15	-77.5	-95.9	-88.5	50132.0
187	34 16.33	116 10.15	2152.71	979446.06	0.14	0.00	0.15	-77.7	-96.0	-88.6	50114.0
188	34 16.48	116 10.17	2147.96	979446.42	0.14	0.00	0.15	-77.9	-96.2	-88.8	50114.0
189	34 16.65	116 10.18	2140.69	979446.97	0.14	0.00	0.15	-78.0	-96.3	-88.9	50129.0
190	34 16.78	116 10.28	2131.96	979447.82	0.15	0.00	0.15	-78.0	-96.2	-88.8	50121.0
191	34 15.07	116 12.90	2584.53	979420.81	0.14	0.00	0.14	-71.6	-93.6	-84.7	50454.0
192	34 15.07	116 13.10	2571.60	979423.11	0.13	0.00	0.13	-70.2	-92.1	-83.3	50409.0
193	34 15.07	116 13.32	2581.98	979421.58	0.11	0.00	0.12	-71.0	-93.1	-84.2	50447.0
194	34 15.08	116 13.50	2583.46	979421.61	0.11	0.00	0.12	-70.9	-92.9	-84.1	50495.0
195	34 15.08	116 13.72	2580.37	979421.83	0.11	0.00	0.12	-70.9	-92.9	-84.0	50567.0
196	34 15.08	116 13.92	2581.35	979421.57	0.12	0.00	0.12	-71.1	-93.1	-84.2	50577.0
197	34 15.08	116 14.13	2594.31	979420.31	0.12	0.00	0.12	-71.4	-93.6	-84.7	50574.0
198	34 15.08	116 14.33	2611.70	979418.98	0.12	0.00	0.13	-71.6	-93.9	-84.9	50532.0
199	34 15.08	116 14.53	2641.72	979416.97	0.13	0.00	0.13	-71.5	-94.1	-85.0	50447.0
200	34 15.08	116 14.73	2684.39	979413.90	0.15	0.00	0.15	-71.7	-94.6	-85.3	50337.0

See footnotes at end of table

TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
201	34 15.20	116 14.82	2708.13	979412.55	0.15	0.00	0.15	-71.5	-94.7	-85.3	50327.0
202	34 15.37	116 14.80	2701.96	979413.39	0.14	0.00	0.15	-71.4	-94.4	-85.1	50427.0
203	34 15.53	116 14.78	2693.38	979414.45	0.14	0.00	0.14	-71.1	-94.1	-84.9	50485.0
204	34 15.70	116 14.85	2682.25	979415.48	0.13	0.00	0.14	-71.1	-94.0	-84.8	50480.0
205	34 15.85	116 14.93	2668.47	979416.59	0.13	0.00	0.14	-71.1	-93.9	-84.7	50430.0
206	34 16.02	116 15.00	2648.72	979418.06	0.13	0.00	0.13	-71.3	-93.9	-84.8	50391.0
207	34 16.17	116 15.02	2628.09	979419.47	0.13	0.00	0.13	-71.5	-93.9	-84.9	50353.0
208	34 16.35	116 15.05	2607.74	979420.97	0.13	0.00	0.13	-71.6	-93.9	-84.9	50330.0
209	34 16.50	116 15.00	2612.12	979420.67	0.13	0.00	0.13	-71.8	-94.2	-85.2	50314.0
210	34 16.63	116 14.87	2589.71	979420.21	0.14	0.00	0.14	-74.0	-96.1	-87.2	50257.0
211	34 15.97	116 14.22	2613.09	979420.62	0.14	0.00	0.14	-71.1	-93.4	-84.4	50403.0
212	34 15.83	116 14.35	2640.02	979418.59	0.14	0.00	0.14	-71.1	-93.6	-84.5	50397.0
213	34 15.67	116 14.50	2666.52	979416.69	0.14	0.00	0.14	-70.9	-93.7	-84.5	50438.0
214	34 15.57	116 14.62	2682.57	979415.42	0.14	0.00	0.14	-70.9	-93.8	-84.6	50484.0
215	34 15.42	116 14.73	2697.16	979413.98	0.14	0.00	0.14	-71.2	-94.2	-84.9	50467.0
216	34 15.08	116 14.93	2714.86	979411.91	0.15	0.00	0.15	-71.6	-94.7	-85.4	50339.0
217	34 15.08	116 15.15	2739.75	979410.34	0.15	0.00	0.15	-71.4	-94.8	-85.4	50384.0
218	34 15.08	116 15.33	2750.52	979409.80	0.15	0.00	0.15	-71.2	-94.7	-85.2	50388.0
219	34 15.08	116 15.53	2759.43	979409.49	0.15	0.00	0.16	-70.9	-94.5	-85.0	50437.0
220	34 15.08	116 15.73	2767.36	979409.06	0.15	0.00	0.16	-70.8	-94.4	-84.9	50488.0
221	34 15.08	116 15.97	2771.11	979408.76	0.15	0.00	0.16	-70.8	-94.5	-85.0	50487.0
222	34 15.08	116 16.15	2773.22	979408.39	0.16	0.00	0.17	-71.1	-94.7	-85.2	50542.0
223	34 15.13	116 16.35	2780.02	979407.96	0.17	0.00	0.17	-71.1	-94.8	-85.3	50526.0
224	34 15.18	116 16.53	2805.73	979406.89	0.22	0.00	0.22	-70.4	-94.3	-84.7	50546.0
225	34 15.30	116 16.68	2831.72	979405.35	0.31	0.00	0.31	-70.3	-94.4	-84.7	50675.0
226	34 15.45	116 16.73	2791.15	979407.77	0.29	0.00	0.29	-70.8	-94.6	-85.0	50485.0
227	34 15.57	116 16.83	2712.71	979412.32	0.15	0.00	0.16	-72.0	-95.1	-85.8	50368.0
228	34 15.63	116 16.98	2695.11	979413.26	0.13	0.00	0.14	-72.3	-95.4	-86.1	50379.0
229	34 15.77	116 17.13	2724.18	979411.28	0.23	0.00	0.23	-72.4	-95.7	-86.3	50453.0

See footnotes at end of table

TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
230	34 15.80	116 17.33	2658.88	979415.40	0.14	0.00	0.14	-72.9	-95.6	-86.5	50236.0
231	34 15.87	116 17.52	2662.10	979415.12	0.14	0.00	0.14	-73.1	-95.8	-86.6	50298.0
232	34 15.92	116 17.68	2673.16	979414.68	0.14	0.00	0.14	-72.8	-95.7	-86.5	50310.0
233	34 15.95	116 17.88	2692.60	979413.87	0.14	0.00	0.14	-72.3	-95.3	-86.1	50319.0
234	34 16.12	116 17.88	2678.87	979414.72	0.13	0.00	0.14	-72.7	-95.5	-86.3	50306.0
235	34 16.28	116 17.88	2668.86	979415.30	0.13	0.00	0.13	-73.0	-95.8	-86.6	51298.0
236	34 16.50	116 17.88	2656.32	979416.13	0.12	0.00	0.13	-73.4	-96.0	-86.9	50291.0
237	34 16.65	116 17.88	2645.32	979416.97	0.12	0.00	0.12	-73.5	-96.1	-87.0	50327.0
238	34 16.82	116 17.88	2634.41	979418.02	0.12	0.00	0.12	-73.4	-95.9	-86.9	50364.0
239	34 17.00	116 17.90	2624.20	979419.03	0.11	0.00	0.12	-73.4	-95.8	-86.7	50339.0
240	34 17.18	116 17.88	2612.26	979420.15	0.12	0.00	0.12	-73.3	-95.6	-86.6	50223.0
241	34 17.37	116 17.88	2590.76	979421.82	0.12	0.01	0.12	-73.4	-95.5	-86.6	50327.0
242	34 17.52	116 17.88	2572.25	979423.16	0.11	0.01	0.12	-73.5	-95.5	-86.6	50342.0
243	34 17.70	116 17.88	2561.47	979424.22	0.11	0.01	0.12	-73.4	-95.3	-86.5	50333.0
244	34 17.87	116 17.88	2545.16	979425.86	0.11	0.01	0.12	-73.2	-94.9	-86.1	50321.0
245	34 18.03	116 17.90	2536.10	979426.91	0.11	0.01	0.11	-73.0	-94.6	-85.9	50349.0
246	34 18.20	116 17.88	2523.36	979428.24	0.10	0.01	0.11	-72.8	-94.3	-85.6	50358.0
247	34 18.37	116 17.88	2508.45	979429.76	0.10	0.01	0.11	-72.5	-93.9	-85.3	50329.0
248	34 18.55	116 17.88	2499.21	979431.14	0.10	0.01	0.11	-72.0	-93.3	-84.7	50331.0
249	34 18.72	116 17.93	2497.67	979431.79	0.10	0.01	0.11	-71.7	-93.0	-84.4	50352.0
250	34 18.87	116 18.00	2497.84	979432.46	0.09	0.01	0.10	-71.2	-92.6	-84.0	50400.0
251	34 19.02	116 18.03	2500.97	979432.85	0.09	0.01	0.10	-70.9	-92.2	-83.6	50379.0
252	34 19.17	116 17.90	2497.00	979433.63	0.09	0.01	0.10	-70.6	-91.9	-83.3	50313.0
253	34 19.30	116 17.80	2493.20	979434.29	0.09	0.01	0.10	-70.3	-91.6	-83.0	50319.0
254	34 19.43	116 17.70	2484.84	979435.40	0.09	0.01	0.10	-70.0	-91.2	-82.7	50346.0
255	34 19.45	116 17.50	2492.53	979435.10	0.09	0.01	0.10	-69.8	-91.1	-82.5	50387.0
256	34 19.45	116 17.27	2506.86	979434.44	0.10	0.01	0.11	-69.4	-90.8	-82.2	50432.0
257	34 19.45	116 17.03	2509.72	979434.53	0.10	0.01	0.11	-69.2	-90.6	-81.9	50351.0
258	34 19.43	116 16.83	2507.74	979434.76	0.10	0.01	0.10	-69.1	-90.5	-81.8	50435.0

See footnotes at end of table

TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
259	34 19.43	116 16.63	2501.08	979435.21	0.09	0.01	0.09	-69.1	-90.4	-81.8	50375.0
260	34 19.45	116 16.43	2487.14	979436.13	0.09	0.01	0.10	-69.1	-90.4	-81.8	50298.0
261	34 19.43	116 16.25	2488.65	979436.14	0.09	0.01	0.10	-69.0	-90.2	-81.7	50322.0
262	34 19.43	116 16.05	2484.81	979436.32	0.09	0.01	0.10	-69.1	-90.3	-81.7	50309.0
263	34 19.43	116 15.83	2478.96	979436.59	0.10	0.01	0.10	-69.2	-90.4	-81.8	50295.0
264	34 19.43	116 15.62	2471.55	979436.95	0.11	0.01	0.12	-69.3	-90.4	-81.9	50323.0
265	34 19.45	116 15.43	2464.73	979437.43	0.12	0.01	0.12	-69.3	-90.4	-81.9	50344.0
266	34 19.48	116 15.23	2444.90	979438.88	0.13	0.01	0.13	-69.3	-90.1	-81.7	50378.0
267	34 19.50	116 15.03	2426.49	979440.32	0.14	0.01	0.15	-69.1	-89.8	-81.5	50359.0
268	34 19.52	116 14.85	2407.73	979441.76	0.17	0.00	0.17	-68.9	-89.5	-81.2	50325.0
269	34 19.53	116 14.65	2376.15	979444.04	0.17	0.01	0.18	-68.9	-89.1	-81.0	50260.0
270	34 19.58	116 14.45	2346.56	979446.22	0.18	0.01	0.18	-68.8	-88.8	-80.7	50240.0
271	34 19.62	116 14.27	2328.99	979446.84	0.19	0.00	0.20	-69.4	-89.2	-81.2	50128.0
272	34 19.65	116 14.03	2325.19	979446.45	0.22	0.00	0.23	-70.0	-89.9	-81.9	50186.0
273	34 19.48	116 13.90	2293.09	979448.50	0.21	0.00	0.22	-70.0	-89.5	-81.7	50308.0
274	34 19.32	116 13.80	2283.46	979448.09	0.22	0.01	0.23	-70.8	-90.3	-82.4	50218.0
275	34 19.15	116 13.72	2237.85	979450.52	0.24	0.01	0.25	-71.2	-90.3	-82.6	50260.0
276	34 18.98	116 13.65	2280.36	979447.07	0.23	0.00	0.23	-71.6	-91.0	-83.2	50246.0
277	34 18.83	116 13.65	2331.48	979443.60	0.23	0.00	0.24	-71.3	-91.2	-83.2	50318.0
278	34 18.67	116 13.62	2352.52	979442.49	0.21	0.00	0.21	-70.8	-90.8	-82.7	50401.0
279	34 18.53	116 13.50	2346.76	979442.51	0.20	0.00	0.20	-71.0	-91.0	-82.9	50395.0
280	34 18.68	116 13.78	2374.30	979441.79	0.21	0.00	0.22	-70.0	-90.2	-82.1	50374.0
281	34 18.78	116 13.93	2382.03	979441.77	0.22	0.00	0.23	-69.6	-89.9	-81.7	50364.0
282	34 18.70	116 14.08	2420.29	979438.88	0.21	0.00	0.22	-69.8	-90.4	-82.1	50414.0
283	34 18.65	116 14.27	2446.50	979436.92	0.21	0.00	0.21	-69.9	-90.7	-82.3	50434.0
284	34 18.63	116 14.47	2487.60	979433.94	0.22	0.00	0.22	-70.0	-91.2	-82.7	50413.0
285	34 18.60	116 14.68	2505.06	979432.65	0.20	0.00	0.20	-70.1	-91.4	-82.8	50371.0
286	34 18.60	116 14.88	2515.95	979431.96	0.18	0.00	0.18	-70.0	-91.5	-82.9	50362.0
287	34 18.60	116 15.10	2523.19	979431.38	0.16	0.01	0.16	-70.1	-91.7	-83.0	50348.0

See footnotes at end of table

TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
288	34 18.60	116 15.30	2528.41	979431.08	0.14	0.01	0.15	-70.1	-91.7	-83.0	50318.0
289	34 18.63	116 15.52	2527.71	979431.35	0.12	0.01	0.13	-69.9	-91.5	-82.8	50275.0
290	34 18.67	116 15.72	2523.61	979431.79	0.11	0.01	0.11	-69.9	-91.4	-82.7	50257.0
291	34 18.72	116 15.87	2518.41	979432.38	0.10	0.01	0.11	-69.7	-91.2	-82.5	50256.0
292	34 18.87	116 15.85	2508.09	979433.41	0.10	0.01	0.11	-69.6	-91.0	-82.4	50272.0
293	34 19.00	116 15.97	2494.60	979434.81	0.10	0.01	0.10	-69.3	-90.6	-82.0	50304.0
294	34 19.12	116 16.10	2498.60	979434.86	0.09	0.01	0.10	-69.1	-90.5	-81.9	50332.0
295	34 19.25	116 16.23	2497.94	979435.26	0.09	0.01	0.10	-69.0	-90.3	-81.7	50341.0
296	34 19.38	116 16.35	2495.90	979435.72	0.09	0.01	0.10	-68.8	-90.2	-81.6	50322.0
297	34 18.55	116 15.57	2517.29	979431.91	0.11	0.01	0.12	-70.0	-91.5	-82.8	50262.0
298	34 18.40	116 15.45	2505.20	979432.45	0.11	0.01	0.11	-70.1	-91.5	-82.8	50254.0
299	34 18.27	116 15.33	2510.32	979431.70	0.11	0.01	0.12	-70.3	-91.7	-83.1	50255.0
300	34 18.12	116 15.18	2526.01	979430.12	0.13	0.01	0.13	-70.6	-92.1	-83.4	50253.0
301	34 17.98	116 15.03	2534.73	979429.05	0.14	0.01	0.15	-70.8	-92.5	-83.8	50255.0
302	34 17.85	116 14.92	2534.11	979428.60	0.17	0.00	0.17	-71.1	-92.7	-84.0	50265.0
303	34 17.73	116 14.82	2495.77	979430.73	0.17	0.00	0.18	-71.4	-92.7	-84.2	50258.0
304	34 17.60	116 14.70	2436.37	979434.21	0.18	0.00	0.18	-71.8	-92.6	-84.2	50262.0
305	34 17.45	116 14.63	2397.79	979436.26	0.19	0.01	0.19	-72.2	-92.7	-84.4	50236.0
306	34 17.30	116 14.73	2431.48	979433.72	0.24	0.00	0.24	-72.2	-92.9	-84.6	50224.0
307	34 17.08	116 14.78	2533.08	979426.23	0.20	0.00	0.20	-72.4	-94.1	-85.3	50257.0
308	34 16.97	116 14.78	2564.34	979423.84	0.19	0.00	0.20	-72.5	-94.4	-85.6	50249.0
309	34 16.83	116 14.68	2553.52	979424.60	0.16	0.00	0.16	-72.4	-94.2	-85.4	50204.0
310	34 16.38	116 15.15	2617.32	979420.17	0.12	0.00	0.12	-71.8	-94.2	-85.2	50259.0
311	34 16.25	116 15.30	2627.85	979419.16	0.12	0.00	0.12	-71.9	-94.4	-85.3	50351.0
312	34 16.13	116 15.43	2639.77	979418.27	0.12	0.00	0.12	-71.8	-94.4	-85.3	50316.0
313	34 16.00	116 15.57	2653.60	979417.46	0.12	0.00	0.12	-71.5	-94.2	-85.1	50309.0
314	34 15.88	116 15.68	2666.52	979416.57	0.12	0.00	0.13	-71.4	-94.1	-85.0	50338.0
315	34 15.77	116 15.82	2684.47	979415.17	0.13	0.00	0.13	-71.4	-94.3	-85.1	50345.0
316	34 15.65	116 15.95	2703.37	979413.77	0.13	0.00	0.13	-71.3	-94.4	-85.1	50349.0

See footnotes at end of table

NWC TP 6747

TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
317	34 15.52	116 16.08	2723.69	979412.30	0.13	0.00	0.14	-71.2	-94.4	-85.1	50397.0
318	34 15.40	116 16.20	2742.63	979410.90	0.14	0.00	0.15	-71.1	-94.5	-85.1	50410.0
319	34 15.28	116 16.33	2763.10	979409.29	0.15	0.00	0.16	-71.1	-94.7	-85.2	50443.0
320	34 17.43	116 14.85	2414.64	979435.67	0.20	0.01	0.20	-71.6	-92.2	-83.9	50285.0
321	34 17.38	116 15.03	2436.29	979434.22	0.18	0.01	0.19	-71.5	-92.3	-83.9	50297.0
322	34 17.35	116 15.22	2460.68	979432.54	0.16	0.01	0.17	-71.5	-92.5	-84.0	50297.0
323	34 17.38	116 15.42	2472.41	979431.93	0.16	0.01	0.16	-71.4	-92.5	-84.0	50282.0
324	34 17.43	116 15.60	2482.15	979431.62	0.17	0.01	0.17	-71.1	-92.2	-83.7	50278.0
325	34 17.40	116 15.80	2493.03	979430.79	0.14	0.01	0.15	-71.1	-92.4	-83.8	50321.0
326	34 17.42	116 16.00	2505.65	979429.84	0.14	0.01	0.15	-71.2	-92.6	-84.0	50372.0
327	34 17.45	116 16.15	2525.32	979428.36	0.12	0.01	0.12	-71.4	-93.0	-84.3	50401.0
328	34 17.42	116 16.35	2529.51	979427.54	0.10	0.01	0.11	-71.9	-93.5	-84.8	50393.0
329	34 17.40	116 16.55	2544.25	979425.58	0.10	0.01	0.10	-72.9	-94.6	-85.8	50367.0
330	34 .7.38	116 16.77	2546.26	979424.71	0.10	0.01	0.10	-73.6	-95.3	-86.6	50292.0
331	34 17.37	116 16.97	2556.66	979423.64	0.10	0.00	0.10	-73.9	-95.8	-87.0	50276.0
332	34 17.37	116 17.17	2567.68	979422.99	0.10	0.00	10	-73.8	-95.8	-86.9	50302.0
333	34 17.37	116 17.37	2577.39	979422.34	0.11	0.00	.11	-73.8	-95.8	-86.9	50330.0
334	34 17.40	116 17.57	2585.77	979421.80	0.10	0.00	0.11	-73.8	-95.9	-87.0	50337.0
335	34 17.38	116 17.72	2593.21	979421.41	0.11	0.01	0.12	-73.6	-95.8	-86.9	50307.0
336	34 15.65	116 16.15	2706.90	979413.46	0.13	0.00	0.13	-71.4	-94.5	-85.2	50374.0
337	34 15.75	116 16.28	2693.20	979414.39	0.12	0.00	0.13	-71.5	-94.5	-85.3	50368.0
338	34 15.92	116 16.33	2672.82	979415.81	0.12	0.00	0.12	-71.7	-94.6	-85.4	50330.0
339	34 16.07	116 16.40	2661.23	979416.45	0.11	0.00	0.12	-72.1	-94.8	-85.7	50295.0
340	34 16.20	116 16.32	2647.58	979417.23	0.11	0.00	0.11	-72.4	-95.1	-85.9	50247.0
341	34 16.37	116 16.30	2629.49	979418.28	0.11	0.00	0.11	-72.9	-95.3	-86.3	50240.0
342	34 16.53	116 16.28	2608.81	979419.49	0.11	0.00	0.11	-73.3	-95.6	86.6	50271.0
343	34 16.72	116 16.27	2590.94	979420.79	0.11	0.00	0.11	-73.5	-95.6	-86.7	50313.0
344	34 16.88	116 16.23	2579.59	979422.12	0.11	0.00	0.11	-73.2	95.2	-86.3	50366.0
345	34 17.07	116 16.22	2562.06	979423.84	0.11	0.00	0.12	-72.9	94.8	-86.0	50385.0

See footnotes at end of table

TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
346	34 17.23	116 16.18	2530.53	979426.89	0.11	0.01	0.12	-72.2	-93.9	-85.2	50384.0
347	34 17.37	116 16.17	2515.83	979428.65	0.12	0.01	0.12	-71.7	-93.2	-84.5	50379.0
348	34 17.52	116 16.33	2527.31	979428.24	0.11	0.01	0.12	-71.5	-93.1	-84.4	50416.0
349	34 17.58	116 16.50	2546.53	979426.68	0.10	0.01	0.11	-71.9	-93.6	-84.9	50447.0
350	34 17.65	116 16.62	2553.15	979426.19	0.10	0.00	0.10	-72.0	-93.8	-85.0	50454.0
351	34 17.73	116 16.78	2542.30	979427.01	0.10	0.01	0.10	-72.0	-93.8	-85.0	50388.0
352	34 17.87	116 16.90	2537.52	979427.69	0.09	0.01	0.10	-71.9	-93.6	-84.8	50388.0
353	34 18.00	116 17.00	2532.67	979428.54	0.09	0.01	0.10	-71.6	-93.2	-84.5	50379.0
354	34 18.12	116 17.10	2530.54	979429.19	0.09	0.01	0.10	-71.2	-92.8	-84.1	50385.0
355	34 18.13	116 17.32	2525.15	979429.21	0.09	0.01	0.10	-71.6	-93.2	-84.5	50397.0
356	34 18.28	116 17.42	2527.17	979429.57	0.09	0.01	0.10	-71.3	-92.9	-84.2	50419.0
357	34 18.40	116 17.53	2521.16	979430.42	0.09	0.01	0.10	-71.0	-92.6	-83.9	50415.0
358	34 18.53	116 17.63	2517.70	979430.92	0.09	0.01	0.10	-70.9	-92.5	-83.8	50402.0
359	34 18.63	116 17.77	2513.33	979431.12	0.10	0.01	0.10	-71.2	-92.7	-84.0	50405.0
360	34 16.77	116 17.68	2628.70	979418.22	0.11	0.00	0.12	-73.6	-96.0	-87.0	50386.0
361	34 16.78	116 17.48	2624.08	979418.60	0.11	0.00	0.12	-73.5	-95.9	-86.9	50400.0
362	34 16.75	116 17.30	2606.33	979419.56	0.11	0.00	0.11	-73.7	-96.0	-87.0	50330.0
363	34 16.67	116 17.12	2589.80	979420.57	0.10	0.00	0.11	-73.7	-95.9	-86.9	50293.0
364	34 16.58	116 16.95	2606.39	979419.35	0.11	0.00	0.12	-73.7	-96.0	-87.0	50283.0
365	34 16.52	116 16.77	2603.60	979419.68	0.12	0.00	0.12	-73.5	-95.7	-86.7	50231.0
366	34 16.47	116 16.58	2621.93	979418.43	0.11	0.00	0.11	-73.4	-95.8	-86.8	50231.0
367	34 16.48	116 16.37	2615.47	979418.86	0.11	0.00	0.11	-73.4	-95.8	-86.8	50247.0
368	34 16.48	116 16.18	2613.84	979419.37	0.11	0.00	0.12	-73.0	-95.3	-86.3	50312.0
369	34 16.50	116 15.98	2609.52	979420.25	0.12	0.00	0.12	-72.5	-94.7	-85.8	50402.0
370	34 16.52	116 15.78	2634.78	979418.58	0.11	0.00	0.12	-72.4	-94.9	-85.9	50426.0
371	34 16.57	116 15.58	2633.03	979418.98	0.12	0.00	0.12	-72.2	-94.7	-85.6	50364.0
372	34 16.58	116 15.37	2624.68	979419.78	0.13	0.00	0.13	-72.0	-94.4	-85.4	50370.0
373	34 16.60	116 15.17	2615.25	979420.54	0.13	0.00	0.13	-71.9	-94.2	-85.2	50328.0
374	34 17.27	116 9.85	2110.29	979448.42	0.02	0.14	0.16	-79.5	-97.5	-90.3	50068.0

See footnotes at end of table

TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
375	34 17.38	116 9.70	2078.24	979450.19	0.04	0.15	0.19	-80.1	-97.8	-90.7	50033.0
376	34 17.48	116 9.58	2053.86	979451.28	0.02	0.16	0.18	-80.8	-98.3	-91.3	50042.0
377	34 17.85	116 9.47	1999.54	979454.24	0.04	0.18	0.22	-82.0	-99.1	-92.2	49979.0
378	34 17.78	116 9.30	1996.83	979454.35	0.03	0.18	0.21	-82.0	-99.1	-92.2	49931.0
379	34 17.87	116 9.10	1973.38	979455.37	0.04	0.19	0.23	-82.7	-99.5	-92.7	...
381	34 17.73	116 9.12	1996.45	979454.12	0.03	0.18	0.21	-82.2	-99.2	-92.4	49864.0
382	34 17.65	116 8.92	2001.97	979453.72	0.03	0.17	0.20	-82.1	-99.2	-92.3	49861.0
383	34 17.55	116 8.77	1998.92	979454.01	0.04	0.17	0.21	-81.9	-98.9	-92.1	49968.0
384	34 17.43	116 8.53	1962.99	979456.55	0.04	0.19	0.23	-81.7	-98.4	-91.6	49967.0
385	34 17.42	116 8.35	1950.71	979457.02	0.07	0.20	0.27	-82.0	-98.6	-91.9	49932.0
386	34 17.42	116 8.15	1927.21	979458.08	0.06	0.22	0.28	-82.5	-98.9	-92.3	49889.0
387	34 17.42	116 7.93	1912.17	979458.51	0.05	0.23	0.28	-83.1	-99.4	-92.8	49882.0
388	34 17.42	116 7.72	1878.39	979460.17	0.06	0.26	0.32	-83.7	-99.7	-93.3	49851.0
389	34 17.43	116 7.52	1829.31	979463.16	0.06	0.33	0.39	-84.0	-99.6	-93.3	49796.0
390	34 17.43	116 7.32	1822.40	979462.62	0.04	0.34	0.38	-85.1	-100.5	-94.3	49762.0
391	34 17.43	116 7.13	1817.65	979462.36	0.03	0.37	0.40	-85.6	-101.0	-94.8	49871.0
392	34 17.43	116 6.90	1821.61	979463.49	0.02	0.39	0.41	-84.2	-99.7	-93.4	49778.0
393	34 17.43	116 6.73	1836.63	979463.14	0.03	0.40	0.43	-83.5	-99.1	-92.8	49775.0
394	34 17.45	116 6.57	1858.11	979462.65	0.03	0.40	0.43	-82.6	-98.3	-92.0	49783.0
395	34 17.45	116 6.72	1843.02	979463.33	0.02	0.41	0.43	-83.1	-98.7	-92.4	49728.0
396	34 17.70	116 6.88	1826.26	979463.96	0.03	0.44	0.47	-83.8	-99.2	-93.0	49843.0
398	34 18.03	116 6.98	1817.80	979464.65	0.04	0.48	0.52	-84.0	-99.4	-93.2	49734.0
400	34 18.32	116 7.20	1821.00	979463.56	0.03	0.47	0.50	-85.3	-100.7	-94.5	49676.0
401	34 18.12	116 7.35	1823.08	979462.65	0.02	0.44	0.46	-86.3	-101.7	-95.5	49648.0
402	34 18.53	116 7.50	1827.71	979462.19	0.02	0.41	0.43	-86.6	-102.1	-95.9	49597.0
403	34 18.65	116 7.67	1825.29	979461.46	0.02	0.39	0.41	-87.7	-103.2	-96.9	49570.0
404	34 18.77	116 7.82	1823.37	979461.23	0.02	0.38	0.40	-88.2	-103.7	-97.5	49553.0
405	34 18.92	116 7.88	1827.20	979460.28	0.02	0.39	0.41	-89.1	-104.6	-98.4	49531.0
406	34 19.08	116 7.97	1824.59	979459.84	0.01	0.39	0.40	-90.0	-105.5	-99.2	49543.0

See footnotes at end of table

TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
407	34 19.25	116 8.05	1820.78	979459.31	0.01	0.39	0.40	-91.0	-106.4	-100.2	49541.0
408	34 19.38	116 8.15	1817.55	979459.20	0.01	0.41	0.42	-91.5	-106.9	-100.7	49540.0
410	34 19.72	116 8.27	1817.29	979458.00	0.01	0.42	0.43	-93.2	-108.6	-102.4	49614.0
411	34 19.88	116 8.35	1816.80	979457.47	0.01	0.45	0.46	-94.0	-109.3	-103.1	49601.0
412	34 20.07	116 8.43	1820.18	979456.61	0.01	0.44	0.45	-94.8	-110.3	-104.1	49654.0
413	34 20.22	116 8.50	1823.53	979456.11	0.01	0.42	0.43	-95.4	-110.8	-104.6	49678.0
414	34 20.38	116 8.55	1829.46	979455.34	0.01	0.41	0.42	-96.0	-111.5	-105.2	49707.0
415	34 20.55	116 8.62	1837.06	979455.28	0.01	0.44	0.45	-95.7	-111.3	-105.0	49734.0
416	34 20.73	116 8.68	1845.76	979455.10	0.01	0.43	0.44	-95.5	-111.2	-104.9	49732.0
417	34 20.90	116 8.70	1856.15	979455.04	0.01	0.43	0.44	-95.1	-110.9	-104.5	49733.0
418	34 21.07	116 8.73	1867.11	979454.93	0.01	0.45	0.46	-94.7	-110.5	-104.1	49749.0
419	34 21.22	116 8.75	1878.18	979454.80	0.01	0.46	0.47	-94.3	-110.2	-103.8	49763.0
420	34 21.40	116 8.80	1890.89	979454.44	0.01	0.45	0.46	-94.0	-110.1	-103.6	49782.0
421	34 21.55	116 8.88	1900.52	979454.18	0.01	0.48	0.49	-93.8	-109.9	-103.4	49780.0
422	34 21.72	116 8.93	1911.21	979454.07	0.01	0.48	0.49	-93.4	-109.6	-103.1	49793.0
423	34 21.88	116 9.03	1923.82	979453.39	0.05	0.48	0.53	-93.4	-109.7	-103.2	49797.0
425	34 22.08	116 9.35	1954.71	979452.46	0.03	0.50	0.53	-92.5	-109.1	-102.4	49777.0
426	34 22.05	116 9.52	1968.84	979451.31	0.02	0.47	0.49	-92.7	-109.4	-102.7	49771.0
427	34 21.92	116 9.33	1949.98	979452.27	0.03	0.43	0.46	-92.9	-109.4	-102.8	49760.0
428	34 21.83	116 9.52	1957.94	979451.48	0.02	0.41	0.43	-93.0	-109.6	-103.0	49757.0
429	34 21.75	116 9.65	1967.03	979450.97	0.04	0.39	0.43	-92.8	-109.5	-102.8	49742.0
430	34 21.62	116 9.82	1964.23	979451.27	0.03	0.36	0.39	-92.6	-109.2	-102.5	49725.0
431	34 21.45	116 10.00	1942.93	979453.18	0.07	0.34	0.41	-91.9	-108.3	-101.7	49708.0
432	34 21.33	116 10.15	1919.51	979455.45	0.08	0.36	0.44	-91.0	-107.3	-100.7	49703.0
433	34 21.22	116 10.32	1921.13	979456.30	0.04	0.36	0.40	-89.9	-106.2	-99.6	49721.0
434	34 21.10	116 10.47	1907.58	979458.62	0.05	0.36	0.41	-88.3	-104.5	-98.0	49746.0
435	34 20.97	116 10.63	1900.69	979460.68	0.05	0.36	0.41	-86.6	-102.7	-96.2	49782.0
436	34 20.87	116 10.78	1922.12	979460.24	0.02	0.31	0.33	-85.5	-101.8	-95.2	49816.0
437	34 20.73	116 10.95	1934.67	979460.81	0.02	0.30	0.32	-83.9	-100.3	-93.7	49907.0

See footnotes at end of table

TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
438	34 20.62	116 11.12	1926.37	979462.15	0.89	0.31	1.20	-82.1	-98.1	-91.7	49984.0
439	34 20.52	116 11.27	1931.53	979462.00	0.02	0.30	0.32	-82.6	-99.0	-92.4	50048.0
440	34 20.40	116 11.43	1933.49	979461.82	0.02	0.29	0.31	-82.5	-98.9	-92.3	50006.0
441	34 20.28	116 11.38	1929.87	979461.67	0.01	0.28	0.29	-82.7	-99.1	-92.5	50001.0
442	34 20.15	116 11.23	1916.81	979462.18	0.01	0.29	0.30	-82.9	-99.2	-92.7	49990.0
444	34 19.90	116 10.97	1891.56	979463.27	0.02	0.29	0.31	-83.2	-99.3	-92.8	49964.0
445	34 19.75	116 10.78	1907.94	979461.43	0.01	0.25	0.26	-83.8	-100.0	-93.5	49949.0
446	34 19.60	116 10.65	1900.65	979461.49	0.02	0.26	0.28	-84.0	-100.2	-93.6	49911.0
447	34 19.47	116 10.55	1900.60	979461.23	0.03	0.26	0.29	-84.0	-100.2	-93.7	49915.0
448	34 19.32	116 10.45	1902.05	979460.96	0.02	0.24	0.26	-84.0	-100.2	-93.7	49918.0
449	34 19.17	116 10.30	1901.45	979460.74	0.02	0.24	0.26	-84.1	-100.3	-93.8	49893.0
450	34 19.03	116 10.17	1899.45	979460.80	0.02	0.24	0.26	-84.0	-100.1	-93.6	49881.0
451	34 18.88	116 10.03	1895.31	979460.82	0.02	0.25	0.27	-84.0	-100.2	-93.7	49878.0
452	34 18.77	116 9.92	1889.75	979461.12	0.04	0.24	0.28	-83.9	-100.0	-93.5	49877.0
453	34 18.63	116 9.77	1887.37	979461.30	0.04	0.25	0.29	-83.7	-99.8	-93.3	49880.0
454	34 18.48	116 9.65	1893.24	979461.03	0.03	0.24	0.27	-83.4	-99.5	-93.0	49899.0
455	34 18.37	116 9.52	1905.03	979460.13	0.04	0.24	0.28	-83.3	-99.5	-93.0	49896.0
456	34 18.23	116 9.38	1918.49	979459.18	0.04	0.22	0.26	-83.2	-99.5	-92.9	49902.0
457	34 18.08	116 9.23	1938.28	979457.66	0.04	0.20	0.24	-83.1	-99.6	-93.0	49892.0
458	34 19.32	116 10.30	1889.99	979461.22	0.02	0.24	0.26	-84.6	-100.7	-94.2	49867.0
459	34 19.43	116 10.15	1870.76	979461.98	0.01	0.27	0.28	-85.3	-101.2	-94.8	49814.0
460	34 19.53	116 9.98	1859.52	979461.77	0.02	0.28	0.30	-86.4	-102.2	-95.8	49774.0
462	34 19.75	116 9.65	1828.69	979461.25	0.01	0.31	0.32	-89.3	-104.8	-98.6	49691.0
463	34 19.78	116 9.45	1829.07	979461.25	0.01	0.31	0.32	-89.3	-104.9	-98.6	49671.0
464	34 19.78	116 9.25	1838.10	979460.06	0.01	0.30	0.31	-89.9	-105.5	-99.2	49657.0
465	34 19.85	116 9.07	1817.21	979457.72	0.01	0.35	0.36	-93.7	-109.2	-102.9	49631.0
466	34 19.90	116 8.85	1816.83	979458.74	0.00	0.39	0.39	-92.8	-108.2	-102.0	49615.0
467	34 19.95	116 8.68	1818.34	979457.72	0.01	0.40	0.41	-93.7	-109.2	-102.9	49638.0
468	34 20.03	116 8.50	1818.92	979457.82	0.11	0.41	0.52	-93.6	-109.0	-102.8	49650.0

See footnotes at end of table

TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
469	34 17.33	116 6.40	1880.17	979461.77	0.03	0.38	0.41	-81.8	-97.7	-91.3	49763.0
470	34 17.22	116 6.27	1895.75	979461.30	0.09	0.37	0.46	-81.0	-97.0	-90.6	49775.0
471	34 17.08	116 6.10	1912.87	979460.74	0.21	0.33	0.54	-80.1	-96.3	-89.8	49777.0
472	34 16.98	116 5.95	1929.24	979460.17	0.00	0.32	0.32	-79.6	-96.0	-89.4	49793.0
473	34 16.83	116 5.77	1924.08	979461.04	0.00	0.34	0.34	-78.9	-95.2	-88.6	49821.0
474	34 16.72	116 5.62	1930.12	979460.84	0.05	0.33	0.38	-78.5	-94.8	-88.2	49843.0
475	34 16.62	116 5.50	1928.52	979461.51	0.13	0.34	0.47	-77.7	-94.0	-87.4	49846.0
476	34 16.52	116 5.35	1933.53	979461.76	0.88	0.33	1.21	-76.2	-92.3	-85.8	49837.0
477	34 16.38	116 5.18	1942.55	979461.97	0.09	0.32	0.41	-76.0	-92.5	-85.8	49859.0
478	34 16.27	116 5.03	1929.24	979463.88	0.15	0.34	0.49	-74.7	-91.1	-84.5	49895.0
479	34 16.15	116 4.88	1931.24	979464.77	0.12	0.34	0.46	-73.6	-89.9	-83.4	49921.0
480	34 15.98	116 4.77	1923.78	979464.97	0.13	0.31	0.44	-73.7	-90.0	-83.4	49901.0
481	34 15.82	116 4.70	1920.70	979464.77	0.12	0.29	0.41	-73.9	-90.2	-83.6	49924.0
482	34 15.65	116 4.65	1921.47	979464.32	0.06	0.27	0.33	-74.1	-90.5	-83.9	49954.0
483	34 15.50	116 4.58	1912.30	979464.59	0.06	0.26	0.32	-74.3	-90.5	-84.0	49949.0
484	34 15.33	116 4.53	1893.12	979465.32	0.05	0.26	0.31	-74.6	-90.7	-84.3	49973.0
485	34 15.18	116 4.48	1872.07	979465.98	0.04	0.27	0.31	-75.2	-91.1	-84.7	49999.0
486	34 15.02	116 4.42	1846.09	979466.90	0.06	0.28	0.34	-75.8	-91.5	-85.2	50025.0
487	34 14.83	116 4.35	1824.23	979467.52	0.00	0.29	0.29	-76.5	-92.0	-85.7	50061.0
488	34 14.65	116 4.28	1806.34	979467.80	0.04	0.30	0.34	-77.1	-92.5	-86.3	50058.0
489	34 14.48	116 4.22	1795.37	979467.73	0.01	0.30	0.31	-77.8	-93.0	-86.9	50045.0
490	34 14.35	116 4.12	1784.40	979467.89	0.04	0.31	0.35	-78.1	-93.3	-87.2	49898.0
491	34 14.22	116 3.98	1771.37	979468.91	0.62	0.32	0.94	-77.2	-92.0	-86.1	49861.0
492	34 14.07	116 3.85	1766.94	979468.52	0.03	0.32	0.35	-78.3	-93.3	-87.2	49892.0
493	34 13.93	116 3.72	1764.18	979468.54	0.05	0.32	0.37	-78.2	-93.2	-87.2	50216.0
494	34 13.80	116 3.58	1771.85	979468.08	0.06	0.31	0.37	-78.0	-93.0	-87.0	49879.0
495	34 13.63	116 3.43	1776.54	979468.02	0.03	0.30	0.33	-77.5	-92.6	-86.6	50089.0
496	34 13.53	116 3.33	1775.38	979468.16	0.04	0.30	0.34	-77.3	-92.4	-86.3	50420.0
497	34 13.40	116 3.20	1774.30	979468.52	0.05	0.29	0.34	-76.8	-91.9	-85.8	50325.0

See footnotes at end of table

TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
498	34 13.27	116 3.08	1774.09	979469.09	0.07	0.31	0.38	-76.1	-91.1	-85.1	50031.0
499	34 13.13	116 2.95	1771.37	979469.37	0.11	0.31	0.42	-75.7	-90.8	-84.7	49946.0
500	34 12.98	116 2.80	1766.30	979470.62	0.09	0.29	0.38	-74.7	-89.7	-83.6	50062.0
501	34 12.83	116 2.78	1765.01	979470.59	0.11	0.28	0.39	-74.6	-89.5	-83.5	50075.0
502	34 12.67	116 2.78	1765.01	979469.66	0.06	0.29	0.35	-75.3	-90.3	-84.3	50013.0
503	34 12.55	116 2.67	1768.85	979469.80	0.07	0.27	0.34	-74.8	-89.8	-83.7	50066.0
504	34 12.50	116 2.45	1776.25	979471.01	0.26	0.26	0.52	-72.8	-87.8	-81.8	50139.0
505	34 12.52	116 2.25	1793.06	979472.03	0.20	0.25	0.45	-70.7	-85.9	-79.8	50109.0
506	34 12.50	116 2.13	1815.83	979472.32	0.10	0.23	0.33	-69.0	-84.4	-78.2	49991.0
507	34 15.55	116 4.40	1931.94	979464.96	0.10	0.29	0.39	-72.6	-89.0	-82.4	49968.0
508	34 15.67	116 4.25	1965.53	979464.06	0.55	0.29	0.84	-70.9	-87.4	-80.7	49930.0
509	34 15.78	116 4.10	1990.64	979464.08	0.17	0.30	0.47	-69.7	-86.6	-79.8	49926.0
510	34 15.77	116 3.92	2016.82	979463.54	0.13	0.28	0.41	-68.5	-85.6	-78.7	49884.0
511	34 15.68	116 3.73	2041.86	979461.98	0.22	0.26	0.48	-68.1	-85.4	-78.5	49939.0
512	34 15.65	116 3.53	2077.79	979460.71	0.15	0.24	0.39	-67.0	-84.6	-77.5	49972.0
513	34 15.57	116 3.32	2088.91	979459.36	0.09	0.21	0.30	-67.5	-85.3	-78.1	49906.0
514	34 15.48	116 3.38	2127.50	979457.32	0.21	0.20	0.41	-66.7	-84.8	-77.5	49809.0
515	34 15.38	116 3.08	2177.50	979454.50	0.11	0.20	0.31	-66.0	-84.6	-77.1	49772.0
516	34 15.33	116 2.90	2184.06	979454.11	0.10	0.20	0.30	-65.9	-84.5	-77.0	49808.0
517	34 15.27	116 2.73	2163.84	979455.41	0.35	0.18	0.53	-65.7	-84.0	-76.6	49781.0
518	34 15.17	116 2.60	2160.10	979456.38	0.86	0.17	1.03	-64.3	-82.5	-75.2	49787.0
519	34 14.98	116 2.38	2181.42	979455.44	0.13	0.18	0.31	-64.3	-82.8	-75.4	49734.0
520	34 14.88	116 2.23	2160.49	979456.76	0.14	0.17	0.31	-64.2	-82.6	-75.2	49688.0
521	34 14.78	116 2.12	2144.77	979457.47	0.10	0.16	0.26	-64.5	-82.8	-75.4	49652.0
522	34 14.67	116 1.95	2106.03	979460.47	0.10	0.15	0.25	-64.0	-82.0	-74.7	49667.0
523	34 14.57	116 1.85	2087.65	979462.00	0.30	0.15	0.45	-63.4	-81.1	-74.0	49756.0
524	34 14.40	116 1.83	2086.17	979462.95	0.13	0.16	0.29	-62.5	-80.3	-73.1	49792.0
525	34 14.35	116 1.65	2050.13	979464.39	0.06	0.16	0.22	-63.5	-81.0	-74.0	49903.0
526	34 14.30	116 1.50	2037.27	979465.91	0.08	0.15	0.23	-62.8	-80.2	-73.2	50184.0

See footnotes at end of table

TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
527	34 14.13	116 1.45	2017.84	979467.49	0.07	0.15	0.22	-62.3	-79.5	-72.6	50079.0
528	34 13.97	116 1.40	2002.37	979468.00	0.08	0.15	0.23	-62.6	-79.7	-72.8	49988.0
529	34 14.40	116 1.83	2111.43	979460.96	0.08	0.16	0.24	-62.8	-80.8	-73.5	50013.0
530	34 14.20	116 2.13	2149.81	979458.32	0.13	0.21	0.34	-62.4	-80.7	-73.3	49827.0
531	34 14.10	116 2.27	2155.91	979457.78	0.17	0.24	0.41	-62.4	-80.7	-73.3	50149.0
532	34 14.05	116 2.37	2169.58	979456.67	0.29	0.27	0.56	-62.3	-80.7	-73.3	49986.0
533	34 14.05	116 2.43	2160.70	979464.51	0.43	0.26	0.69	-59.7	-73.2	-65.8	...
534	34 14.03	116 2.62	2020.95	979464.51	0.31	0.18	0.49	-64.7	-81.8	-74.9	49958.0
535	34 13.92	116 2.80	1938.50	979467.95	0.47	0.20	0.67	-66.0	-82.9	-76.3	50132.0
536	34 13.75	116 2.88	1880.60	979467.57	0.20	0.24	0.44	-70.9	-86.8	-80.4	50209.0
537	34 13.65	116 3.00	1836.53	979468.56	0.14	0.28	0.42	-72.8	-88.4	-82.1	50151.0
538	34 13.53	116 3.13	1796.02	979468.83	0.09	0.29	0.38	-75.2	-90.4	-84.3	49923.0
539	34 13.80	116 1.35	1986.54	979470.04	0.05	0.16	0.21	-61.5	-78.4	-71.6	49941.0
540	34 13.63	116 1.30	1964.02	979470.31	0.01	0.16	0.17	-62.6	-79.3	-72.6	49921.0
541	34 13.45	116 1.25	1938.72	979472.23	0.05	0.17	0.22	-62.1	-78.6	-71.9	49989.0
542	34 13.40	116 9.13	1915.53	979473.51	0.06	0.56	0.62	-61.9	-78.1	-71.6	49832.0
543	34 13.12	116 1.08	1893.88	979475.03	0.03	0.19	0.22	-61.9	-78.0	-71.5	49916.0
544	34 12.95	116 1.08	1876.38	979475.73	0.03	0.19	0.22	-62.1	-78.1	-71.7	49906.0
545	34 12.75	116 1.08	1855.26	979476.62	0.03	0.21	0.24	-62.4	-78.2	-71.8	49944.0
546	34 12.53	116 1.08	1831.22	979477.58	0.02	0.21	0.23	-62.8	-78.4	-72.1	49947.0
547	34 12.37	116 1.10	1816.29	979477.80	0.02	0.21	0.23	-63.3	-78.8	-72.6	49953.0
548	34 12.20	116 1.08	1804.00	979477.67	0.01	0.24	0.25	-64.1	-79.4	-73.2	49850.0
549	34 12.05	116 1.10	1792.22	979478.10	0.01	0.24	0.25	-64.2	-79.5	-73.3	49887.0
550	34 11.85	116 1.08	1795.44	979477.70	0.01	0.23	0.24	-64.2	-79.4	-73.3	49947.0
551	34 11.65	116 1.08	1798.02	979477.03	0.01	0.26	0.27	-64.3	-79.6	-73.5	50053.0
552	34 11.65	116 1.28	1803.25	979476.89	0.02	0.25	0.27	-64.1	-79.5	-73.3	50232.0
553	34 11.65	116 1.47	1809.07	979475.91	0.01	0.26	0.27	-64.7	-80.1	-73.9	50203.0
554	34 11.65	116 1.68	1809.54	979473.03	3.40	0.27	3.67	-64.1	-78.4	-72.7	50372.0
555	34 11.65	116 1.88	1810.24	979469.87	0.00	0.26	0.27	-70.7	-86.1	-79.8	50238.0

See footnotes at end of table

TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm^3			Complete Bouguer anomalies,[d] g/cm^3			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
556	34 11.65	116 2.15	1818.32	979466.15	0.02	0.28	0.30	-73.8	-89.3	-83.0	50210.0
557	34 11.80	116 2.13	1811.21	979467.58	0.02	0.24	0.26	-73.1	-88.5	-82.3	50205.0
558	34 11.97	116 2.13	1824.96	979467.58	0.04	0.24	0.28	-72.4	-87.9	-81.6	50162.0
559	34 12.13	116 2.13	1794.45	979470.94	0.02	0.26	0.28	-71.3	-86.6	-80.4	50178.0
560	34 12.30	116 2.13	1788.91	979472.66	0.08	0.24	0.32	-70.2	-85.4	-79.3	50175.0
561	34 11.47	116 2.15	1818.64	979465.12	0.00	0.27	0.28	-74.6	-90.0	-83.8	50242.0
562	34 11.30	116 2.15	1817.24	979464.31	0.01	0.27	0.28	-75.2	-90.7	-84.5	50238.0
563	34 11.13	116 2.15	1809.83	979462.69	0.02	0.32	0.34	-77.1	-92.4	-86.2	50229.0
564	34 10.97	116 2.15	1801.00	979463.31	0.00	0.33	0.33	-76.8	-92.1	-86.0	50221.0
565	34 10.78	116 2.15	1794.06	979463.25	0.01	0.33	0.34	-77.1	-92.3	-86.2	50204.0
566	34 10.62	116 2.15	1779.42	979463.47	0.02	0.34	0.36	-77.6	-92.7	-86.6	50173.0
567	34 10.45	116 2.15	1779.68	979463.00	0.05	0.41	0.46	-77.7	-92.8	-86.7	50146.0
568	34 10.28	116 2.13	1782.11	979462.62	0.03	0.41	0.44	-77.7	-92.8	-86.8	50134.0
569	34 10.08	116 2.13	1790.94	979457.60	1.28	0.41	1.69	-80.6	-95.4	-89.5	50104.0
570	34 9.90	116 2.15	1803.18	979461.02	0.02	0.49	0.51	-77.3	-92.6	-86.4	50095.0
571	34 9.90	116 1.92	1805.62	979460.89	0.01	0.44	0.45	-77.3	-92.6	-86.4	50026.0
572	34 9.90	116 1.72	1803.07	979461.30	0.25	0.45	0.70	-76.8	-92.0	-85.9	50241.0
573	34 9.90	116 1.45	1805.85	979462.74	0.05	0.44	0.49	-75.4	-90.7	-84.5	50384.0
574	34 9.90	116 1.22	1795.77	979465.57	0.08	0.42	0.50	-73.3	-88.5	-82.4	50495.0
575	34 9.92	116 1.02	1790.41	979467.55	0.08	0.42	0.50	-71.7	-86.8	-80.7	50550.0
576	34 9.92	116 0.87	1798.47	979467.98	0.03	0.41	0.44	-70.7	-86.0	-79.8	50539.0
577	34 9.92	116 0.60	1807.80	979468.61	0.02	0.38	0.40	-69.5	-84.9	-78.7	50537.0
579	34 9.92	116 0.12	1817.79	979469.55	0.01	0.37	0.38	-67.9	-83.3	-77.1	50437.0
580	34 9.93	116 0.02	1813.54	979470.51	0.01	0.35	0.36	-67.3	-82.7	-76.5	50422.0
581	34 10.10	116 0.02	1794.06	979472.89	0.02	0.30	0.32	-66.5	-81.8	-75.6	50422.0
582	34 10.30	116 0.02	1764.95	979476.20	0.02	0.32	0.34	-65.5	-80.5	-74.4	50417.0
583	34 10.47	116 0.02	1731.73	979479.37	0.02	0.34	0.36	-64.8	-79.5	-73.6	50321.0
584	34 10.72	116 0.02	1748.25	979479.20	0.02	0.28	0.30	-64.2	-79.1	-73.1	50326.0

See footnotes at end of table

TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
585	34 10.90	116 0.03	1743.94	979480.35	0.01	0.28	0.29	-63.6	-78.5	-72.5	50380.0
586	34 11.07	116 0.03	1759.46	979480.02	0.01	0.27	0.28	-63.2	-78.1	-72.1	50367.0
587	34 11.23	116 0.03	1774.08	979479.86	0.01	0.23	0.24	-62.6	-77.7	-71.6	50359.0
588	34 11.42	116 0.02	1776.37	979480.63	0.00	0.23	0.23	-61.9	-77.0	-71.0	50260.0
589	34 11.67	116 0.12	1773.96	979481.79	0.00	0.25	0.25	-61.3	-76.4	-70.3	50113.0
590	34 11.67	116 0.23	1778.43	979480.29	0.00	0.25	0.25	-62.4	-77.6	-71.5	49973.0
591	34 11.65	116 0.45	1783.33	979479.29	0.00	0.25	0.25	-63.1	-78.3	-72.2	50049.0
592	34 11.65	116 0.63	1786.83	979478.44	0.00	0.24	0.25	-63.7	-78.9	-72.8	50023.0
593	34 11.65	116 0.88	1792.58	979477.15	0.01	0.26	0.27	-64.6	-79.8	-73.7	50002.0
594	34 11.48	116 1.10	1801.16	979476.14	0.00	0.25	0.25	-64.8	-80.1	-73.9	50246.0
595	34 11.32	116 1.10	1803.97	979475.49	0.00	0.25	0.25	-65.0	-80.4	-74.2	50381.0
596	34 11.15	116 1.10	1800.23	979474.90	0.00	0.29	0.29	-65.6	-80.9	-74.7	50457.0
597	34 10.97	116 1.10	1797.28	979474.29	0.00	0.29	0.29	-66.2	-81.4	-75.3	50393.0
598	34 10.80	116 1.10	1786.84	979473.59	0.00	0.29	0.30	-67.3	-82.5	-76.4	50399.0
599	34 10.63	116 1.10	1800.48	979471.52	0.01	0.29	0.30	-68.2	-83.5	-77.4	50304.0
600	34 10.45	116 1.10	1790.40	979470.65	0.01	0.34	0.35	-69.5	-84.7	-78.5	50481.0
601	34 10.35	116 1.08	1783.81	979470.49	0.24	0.35	0.59	-69.7	-84.8	-78.7	50486.0
602	34 10.17	116 1.08	1764.75	979470.82	0.37	0.37	0.74	-70.3	-85.1	-79.1	50503.0
603	34 10.03	116 1.08	1771.88	979469.30	0.36	0.43	0.79	-71.1	-86.0	-80.0	50514.0
604	34 11.65	116 2.35	1817.33	979464.22	0.02	0.28	0.30	-75.8	-91.2	-85.0	50180.0
605	34 11.63	116 2.55	1819.05	979462.11	0.03	0.28	0.31	-77.8	-93.2	-87.0	50125.0
606	34 11.63	116 2.75	1820.87	979460.72	0.03	0.29	0.32	-79.0	-94.5	-88.2	50085.0
607	34 11.62	116 3.02	1786.13	979461.72	0.01	0.31	0.32	-80.4	-95.5	-89.4	50017.0
608	34 11.62	116 3.22	1792.56	979459.34	0.01	0.31	0.32	-82.3	-97.5	-91.4	49957.0
609	34 11.62	116 3.42	1798.50	979459.19	0.02	0.32	0.34	-82.0	-97.3	-91.1	49949.0
610	34 11.62	116 3.63	1801.01	979458.71	0.01	0.32	0.33	-82.3	-97.6	-91.5	49949.0
611	34 11.60	116 3.85	1806.83	979458.23	0.01	0.32	0.33	-82.4	-97.8	-91.6	49954.0
612	34 11.60	116 4.05	1809.49	979458.08	0.01	0.34	0.35	-82.4	-97.7	-91.5	49968.0
613	34 11.60	116 4.25	1820.27	979457.52	0.01	0.34	0.35	-82.2	-97.6	-91.4	49980.0

See footnotes at end of table

TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
614	34 11.60	116 4.48	1839.28	979456.50	0.01	0.33	0.34	-81.9	-97.5	-91.2	50000.0
615	34 11.60	116 4.67	1853.93	979456.05	0.01	0.34	0.35	-81.3	-97.1	-90.7	50015.0
616	34 11.58	116 4.87	1867.43	979455.42	0.03	0.34	0.37	-81.0	-96.9	-90.5	50026.0
617	34 11.58	116 5.05	1883.38	979454.90	0.10	0.34	0.44	-80.4	-96.3	-89.9	50032.0
618	34 11.58	116 5.28	1911.81	979453.66	0.02	0.32	0.34	-79.7	-96.0	-89.4	50057.0
619	34 11.58	116 5.50	1930.97	979452.94	0.02	0.34	0.36	-79.1	-95.5	-88.9	50056.0
620	34 11.58	116 5.70	1938.75	979453.09	0.02	0.34	0.36	-78.5	-94.9	-88.3	50079.0
621	34 11.58	116 5.90	1934.25	979453.98	0.04	0.34	0.38	-77.8	-94.3	-87.6	50087.0
622	34 11.58	116 6.22	2016.84	979449.17	0.07	0.32	0.39	-77.0	-94.1	-87.2	50116.0
623	34 11.58	116 6.43	2044.45	979447.64	0.50	0.31	0.81	-76.2	-93.4	-86.5	50152.0
624	34 11.58	116 6.60	2082.41	979445.70	0.04	0.31	0.35	-76.0	-93.7	-86.4	50158.0
625	34 11.58	116 6.73	2104.83	979444.45	0.04	0.30	0.34	-75.7	-93.6	-86.4	50178.0
626	34 11.60	116 6.97	2104.01	979445.39	0.03	0.30	0.33	-74.9	-92.8	-85.6	50241.0
627	34 11.60	116 7.17	2129.01	979443.98	0.03	0.29	0.32	-74.6	-92.7	-85.4	50263.0
628	34 11.60	116 7.37	2151.23	979442.96	0.02	0.29	0.31	-74.1	-92.4	-85.0	50276.0
629	34 11.68	116 7.57	2161.35	979442.56	0.03	0.29	0.32	-73.9	-92.3	-84.9	50262.0
630	34 11.78	116 7.78	2181.75	979441.25	0.04	0.23	0.27	-74.0	-92.6	-85.1	50233.0
631	34 11.83	116 7.92	2197.48	979439.95	0.05	0.24	0.29	-74.3	-93.0	-85.5	50263.0
632	34 11.92	116 8.10	2214.64	979439.08	0.05	0.23	0.28	-74.1	-92.9	-85.3	50312.0
633	34 11.98	116 8.27	2239.70	979437.69	0.02	0.23	0.25	-73.9	-93.0	-85.3	50356.0
634	34 12.07	116 8.47	2250.04	979437.02	0.02	0.23	0.25	-74.0	-93.2	-85.4	50390.0
635	34 12.15	116 8.63	2257.77	979436.55	0.02	0.22	0.24	-74.0	-93.3	-85.5	50386.0
636	34 12.22	116 8.82	2264.31	979436.18	0.02	0.22	0.24	-74.1	-93.4	-85.6	50400.0
637	34 12.30	116 9.00	2293.94	979433.93	0.04	0.19	0.23	-74.4	-93.9	-86.1	50384.0
638	34 12.35	116 9.12	2284.12	979434.75	0.04	0.19	0.23	-74.3	-93.8	-86.0	50382.0
640	34 12.52	116 9.52	2190.66	979441.09	0.04	0.23	0.27	-74.6	-93.2	-85.7	...
641	34 12.57	116 9.70	2199.17	979440.72	0.08	0.23	0.31	-74.4	-93.1	-85.6	50233.0
642	34 12.65	116 9.82	2215.69	979440.02	0.03	0.22	0.25	-74.1	-93.0	-85.4	50362.0
643	34 12.73	116 10.02	2245.91	979438.43	0.04	0.21	0.25	-73.8	-92.9	-85.2	50371.0
											50383.0

See footnotes at end of table

TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
644	34 12.78	116 10.22	2281.08	979436.12	0.08	0.20	0.28	-73.7	-93.1	-85.3	50439.0
645	34 12.87	116 10.35	2310.80	979434.78	0.24	0.17	0.41	-73.0	-92.7	-84.7	50463.0
646	34 12.95	116 10.53	2359.79	979433.86	0.08	0.16	0.24	-70.9	-91.0	-82.9	50508.0
647	34 13.03	116 10.72	2413.57	979427.78	0.07	0.17	0.24	-73.4	-93.9	-85.6	50579.0
648	34 13.10	116 10.88	2457.85	979425.74	0.06	0.18	0.24	-72.5	-93.4	-85.0	50583.0
649	34 13.18	116 11.08	2496.14	979423.15	0.19	0.19	0.38	-72.4	-93.6	-85.1	50532.0
650	34 13.25	116 11.25	2501.06	979422.08	0.08	0.18	0.26	-73.4	-94.7	-86.1	50449.0
651	34 13.35	116 11.50	2488.13	979423.01	0.06	0.17	0.23	-73.5	-94.7	-86.2	50316.0
652	34 13.42	116 11.67	2432.53	979426.93	0.12	0.14	0.26	-73.4	-94.2	-85.8	50285.0
653	34 13.50	116 11.85	2428.33	979427.45	0.06	0.15	0.21	-73.4	-94.1	-85.7	50317.0
654	34 13.58	116 12.02	2453.88	979425.97	0.03	0.14	0.17	-73.3	-94.2	-85.7	50348.0
655	34 13.65	116 12.20	2477.80	979425.06	0.03	0.14	0.17	-72.6	-93.8	-85.2	50364.0
656	34 13.73	116 12.38	2496.80	979257.47	0.02	0.14	0.16	-239.0	-260.3	-251.8	...
657	34 13.82	116 12.57	2520.63	979423.35	0.02	0.14	0.16	-71.6	-93.1	-84.5	50441.0
658	34 13.93	116 12.65	2533.22	979423.75	0.02	0.13	0.15	-70.6	-92.2	-83.5	50455.0
659	34 14.10	116 12.65	2531.49	979422.85	0.02	0.13	0.15	-71.8	-93.4	-84.7	50407.0
660	34 14.20	116 12.77	2539.40	979422.52	0.03	0.13	0.16	-71.7	-93.4	-84.7	50458.0
661	34 14.20	116 12.97	2559.90	979421.25	0.12	0.13	0.25	-71.5	-93.3	-84.5	50493.0
662	34 14.20	116 13.15	2570.28	979420.46	0.02	0.13	0.15	-71.7	-93.6	-84.8	50542.0
663	34 14.20	116 13.38	2592.48	979418.62	0.01	0.13	0.14	-72.0	-94.1	-85.2	50522.0
664	34 14.20	116 13.57	2599.18	979417.94	0.02	0.13	0.15	-72.2	-94.4	-85.5	50448.0
665	34 14.20	116 13.75	2615.63	979416.75	0.01	0.12	0.13	-72.3	-94.6	-85.6	50366.0
666	34 14.28	116 13.63	2607.43	979417.82	0.01	0.13	0.14	-71.9	-94.2	-85.2	50450.0
667	34 14.38	116 13.52	2609.08	979418.00	0.01	0.13	0.14	-71.7	-94.0	-85.0	50581.0
668	34 14.50	116 13.37	2594.60	979419.49	0.01	0.12	0.13	-71.4	-93.6	-84.6	50634.0
669	34 14.62	116 13.23	2600.03	979419.57	0.01	0.13	0.14	-71.1	-93.3	-84.4	50561.0
670	34 14.72	116 13.08	2594.73	979420.06	0.01	0.13	0.14	-71.1	-93.3	-84.4	50479.0
671	34 14.83	116 12.93	2589.56	979420.25	0.02	0.14	0.16	-71.5	-93.6	-84.6	50450.0
672	34 14.95	116 12.80	2596.09	979419.73	0.04	0.15	0.19	-71.6	-93.8	-84.9	50460.0
673	34 13.33	116 11.13	2524.99	979421.27	0.05	0.21	0.26	-72.6	-94.2	-85.5	50454.0

See footnotes at end of table

TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
674	34 13.33	116 10.93	2480.79	979425.18	0.04	0.19	0.23	-71.8	-92.9	-84.4	50569.0
676	34 13.33	116 10.72	2403.39	979430.11	0.07	0.16	0.23	-72.2	-92.7	-84.4	...
677	34 13.33	116 10.30	2385.93	979430.95	0.09	0.17	0.26	-72.5	-92.8	-84.6	50561.0
678	34 13.33	116 10.10	2344.41	979432.71	0.07	0.17	0.24	-73.6	-93.6	-85.5	50521.0
679	34 13.33	116 9.88	2307.83	979435.32	0.06	0.17	0.23	-73.5	-93.2	-85.2	50524.0
680	34 13.33	116 9.68	2282.79	979436.73	0.07	0.17	0.24	-73.8	-93.3	-85.4	50483.0
681	34 13.33	116 9.47	2309.27	979434.95	0.04	0.17	0.21	-73.8	-93.5	-85.6	50454.0
682	34 13.33	116 9.25	2312.89	979434.53	0.02	0.18	0.20	-74.0	-93.7	-85.8	50461.0
683	34 13.33	116 9.05	2293.16	979435.68	0.03	0.18	0.21	-74.2	-93.7	-85.8	50408.0
684	34 13.32	116 8.85	2269.83	979437.26	0.03	0.18	0.21	-74.2	-93.5	-85.7	50374.0
685	34 13.33	116 8.63	2240.16	979438.95	0.04	0.18	0.22	-74.5	-93.6	-85.9	50359.0
686	34 13.33	116 8.43	2209.53	979440.78	0.10	0.18	0.28	-74.7	-93.5	-86.0	50336.0
687	34 13.33	116 8.23	2182.07	979442.25	0.05	0.19	0.24	-75.2	-93.8	-86.3	50370.0
688	34 13.33	116 8.03	2132.10	979445.14	0.06	0.20	0.26	-75.7	-93.8	-86.5	50345.0
689	34 13.33	116 7.83	2094.23	979447.07	0.06	0.20	0.26	-76.4	-94.2	-87.0	50365.0
690	34 13.33	116 7.63	2059.80	979448.92	0.06	0.22	0.27	-76.9	-94.4	-87.3	50362.0
691	34 13.33	116 7.37	2062.78	979448.30	0.04	0.21	0.25	-77.3	-94.9	-87.8	50404.0
692	34 13.33	116 7.17	2021.53	979450.78	0.05	0.21	0.26	-77.6	-94.8	-87.9	50374.0
693	34 13.33	116 6.95	1993.64	979452.43	0.02	0.23	0.25	-77.9	-94.9	-88.0	50386.0
694	34 13.33	116 6.73	1973.13	979453.60	0.02	0.23	0.25	-78.1	-94.9	-88.2	50381.0
695	34 13.33	116 6.53	1956.63	979454.17	0.02	0.23	0.25	-78.7	-95.4	-88.6	50380.0
696	34 13.33	116 6.37	1941.28	979454.36	0.82	0.23	1.05	-78.8	-95.0	-88.5	50380.0
697	34 15.08	116 9.30	2228.13	979440.26	0.01	0.12	0.13	-76.6	-95.6	-87.9	50391.0
698	34 15.08	116 9.08	2210.90	979441.01	0.02	0.12	0.14	-77.0	-95.9	-88.3	50202.0
699	34 15.15	116 8.92	2192.78	979442.06	0.02	0.12	0.14	-77.3	-96.0	-88.5	50184.0
700	34 15.27	116 8.78	2174.64	979442.77	0.02	0.12	0.14	-78.0	-96.5	-89.1	50159.0
701	34 15.40	116 8.65	2158.65	979443.82	0.02	0.12	0.14	-78.2	-96.6	-89.2	50118.0
702	34 15.52	116 8.52	2139.83	979445.07	0.02	0.12	0.14	-78.4	-96.7	-89.3	50085.0
703	34 15.65	116 8.37	2121.62	979445.13	0.01	0.12	0.13	-79.8	-97.9	-90.6	50066.0

See footnotes at end of table

TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
704	34 15.80	116 4.22	2112.33	979446.52	0.01	0.25	0.26	-79.1	-97.1	-89.9	50073.0
705	34 15.87	116 8.07	2103.83	979447.20	0.01	0.13	0.13	-79.2	-97.2	-90.0	50115.0
706	34 16.02	116 7.97	2099.84	979447.36	0.01	0.13	0.14	-79.6	-97.5	-90.3	50073.0
707	34 16.10	116 7.83	2095.65	979447.02	0.01	0.13	0.14	-80.3	-98.2	-91.0	50064.0
708	34 16.17	116 7.65	2086.56	979448.07	0.02	0.14	0.16	-80.0	-97.8	-90.6	50051.0
709	34 16.22	116 7.43	2095.77	979446.55	0.10	0.15	0.25	-80.8	-98.7	-91.5	50036.0
710	34 16.25	116 7.30	2090.94	979446.57	0.07	0.15	0.22	-81.2	-99.0	-91.9	49987.0
711	34 16.27	116 7.15	2079.61	979447.09	0.09	0.16	0.25	-81.5	-99.2	-92.0	49964.0
712	34 16.32	116 7.02	2058.16	979448.25	0.21	0.16	0.37	-81.7	-99.2	-92.2	49939.0
713	34 16.53	116 7.00	1929.30	979456.85	0.11	0.21	0.32	-82.3	-98.7	-92.1	49935.0
714	34 16.63	116 6.85	1882.13	979461.08	0.07	0.27	0.34	-81.4	-97.4	-91.0	49906.0
715	34 16.75	116 6.68	1830.30	979462.53	0.05	0.34	0.39	-83.6	-99.2	-92.9	49850.0
716	34 16.77	116 6.48	1841.95	979462.54	0.03	0.33	0.36	-82.9	-98.5	-92.2	49830.0
717	34 16.83	116 6.30	1871.77	979461.51	0.03	0.32	0.35	-82.0	-97.9	-91.5	49754.0
718	34 16.88	116 6.10	1899.11	979460.85	0.12	0.32	0.44	-80.7	-96.8	-90.4	49753.0
719	34 14.67	116 4.50	1796.27	979463.39	0.02	0.30	0.32	-82.3	-97.5	-91.4	49757.0
720	34 14.67	116 4.72	1800.70	979465.99	0.02	0.28	0.30	-79.4	-94.7	-88.5	49772.0
721	34 14.67	116 4.92	1812.83	979463.78	0.03	0.26	0.29	-80.8	-96.2	-90.0	50059.0
722	34 14.65	116 5.13	1840.68	979461.80	0.07	0.23	0.30	-80.8	-96.5	-90.2	50059.0
723	34 14.65	116 5.33	1853.68	979460.56	0.02	0.22	0.24	-81.2	-97.0	-90.6	50028.0
724	34 11.77	116 5.30	1893.63	979454.62	0.09	0.30	0.39	-80.2	-96.3	-89.8	49940.0
725	34 11.93	116 5.30	1873.93	979455.75	0.02	0.29	0.31	-80.8	-96.7	-90.3	...
726	34 12.10	116 5.30	1854.23	979457.15	0.03	0.32	0.35	-80.9	-96.6	-90.3	50087.0
727	34 12.27	116 5.30	1840.38	979458.19	0.04	0.33	0.37	-81.0	-96.6	-90.4	50115.0
728	34 12.43	116 5.30	1833.35	979458.76	0.03	0.30	0.33	-81.2	-96.8	-90.5	50147.0
729	34 12.60	116 5.30	1835.00	979458.79	0.03	0.29	0.32	-81.3	-96.9	-90.6	50177.0
730	34 12.77	116 5.30	1832.53	979459.22	0.02	0.29	0.31	-81.3	-96.9	-90.6	50204.0
731	34 12.93	116 5.30	1833.36	979459.08	0.02	0.26	0.28	-81.7	-97.2	-91.0	50224.0
732	34 13.15	116 5.32	1836.95	979458.95	0.02	0.26	0.28	-81.8	-97.5	-91.2	50227.0
733	34 1_.32	116 5.32	1834.91	979459.22	0.02	0.26	0.28	-81.9	-97.5	-91.3	50224.0

See footnotes at end of table

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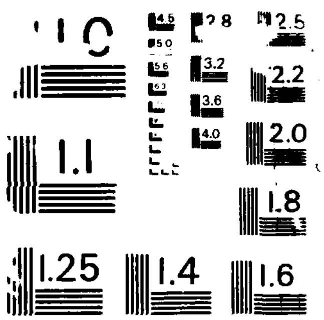

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TABLE B-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.00	2.67	2.40	
734	34 13.48	116 5.32	1839.10	979459.09	0.02	0.24	0.26	-82.0	-97.7	-91.4	50192.0
735	34 13.67	116 5.32	1832.19	979459.25	0.03	0.24	0.27	-82.6	-98.2	-91.9	50176.0
736	34 13.83	116 5.32	1846.71	979459.11	0.03	0.23	0.26	-82.0	-97.7	-91.4	50177.0
737	34 14.00	116 5.32	1845.27	979459.54	0.03	0.22	0.25	-81.9	-97.6	-91.3	50157.0
738	34 14.18	116 5.32	1843.86	979459.92	0.04	0.23	0.27	-81.9	-97.5	-91.2	50167.0
739	34 14.35	116 5.32	1849.32	979459.96	0.03	0.23	0.26	-81.7	-97.4	-91.1	50142.0
740	34 14.52	116 5.33	1850.91	979461.17	0.04	0.22	0.26	-80.6	-96.3	-90.0	50109.0
741	34 13.35	116 5.55	1847.72	979459.00	0.03	0.26	0.29	-81.3	-97.0	-90.7	50092.0
742	34 13.33	116 5.70	1862.17	979458.72	0.02	0.25	0.27	-80.6	-96.4	-90.1	50055.0
743	34 13.33	116 5.90	1885.60	979457.57	0.04	0.24	0.28	-80.1	-96.2	-89.7	50247.0
744	34 13.33	116 6.10	1941.05	979453.99	0.04	0.23	0.27	-79.9	-96.5	-89.8	50290.0
745	34 13.02	116 4.25	1757.18	979462.22	0.01	0.28	0.29	-83.8	-98.8	-92.7	50335.0
746	34 12.83	116 4.25	1755.17	979462.11	0.56	0.28	0.84	-83.3	-98.0	-92.1	50379.0
747	34 12.68	116 4.25	1767.67	979460.90	0.01	0.29	0.30	-84.0	-99.0	-92.9	49971.0
748	34 12.68	116 4.03	1762.71	979461.13	0.00	0.29	0.29	-84.1	-99.1	-93.0	49989.0
749	34 12.55	116 3.90	1760.51	979461.39	0.00	0.28	0.28	-83.8	-98.8	-92.7	49974.0
750	34 12.50	116 3.70	1764.33	979461.71	0.00	0.28	0.28	-83.2	-98.2	-92.1	49935.0
751	34 12.43	116 3.53	1758.64	979462.56	0.00	0.28	0.28	-82.6	-97.5	-91.5	49954.0
752	34 12.40	116 3.47	1764.93	979462.18	0.00	0.28	0.28	-82.5	-97.5	-91.4	49953.0
753	34 12.28	116 3.30	1762.89	979463.24	0.00	0.27	0.27	-81.4	-96.4	-90.4	49953.0
754	34 12.17	116 3.18	1767.91	979463.09	2.31	0.29	2.60	-78.7	-93.0	-87.2	...
755	34 11.98	116 3.20	1775.76	979462.13	0.01	0.28	0.29	-81.2	-96.3	-90.2	49998.0
756	34 11.77	116 3.18	1783.41	979461.19	0.04	0.27	0.31	-81.3	-96.5	-90.3	50006.0
757	34 13.28	116 4.30	1755.37	979462.75	0.00	0.29	0.29	-83.8	-98.7	-92.7	50022.0
758	34 13.55	116 4.42	1755.67	979463.61	0.00	0.28	0.28	-83.3	-98.2	-92.2	49994.0
759	34 13.62	116 4.68	1777.68	979462.33	0.03	0.27	0.30	-83.1	-98.3	-92.2	49978.0
760	34 13.55	116 4.97	1796.30	979461.52	0.03	0.25	0.28	-82.6	-97.9	-91.7	49985.0

[a] Latitude and longitude from state-plane coordinates, AK Zone 10
[b] Drift-corrected observed gravity
[c] Terrain correction
[d] Bouguer anomalies use the 1967 formula for latitude corrections

Appendix C

PRINCIPAL GRAVITY AND MAGNETIC DATA, LAVIC LAKE

Table C-1 presents the principal gravity and magnetic data gathered from the Lavic Lake area at MCAGCC, Twentynine Palms. Total amounts listed under the terrain correction heading may not equal the sum of the inner zone and outer zone terrain corrections because of rounding.

TABLE C-1. Principal Gravity and Magnetic Data, Lavic Lake.

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.67	2.40	2.00	
1	34 43.67	116 18.72	2170.40	979496.15	0.03	0.16	0.19	-83.3	-75.8	-64.8	49914
2	34 43.62	116 18.78	2166.70	979495.78	0.04	0.16	0.20	-84.0	-76.3	-65.3	50273
3	34 43.45	116 18.85	2140.80	979497.92	0.05	0.17	0.22	-82.9	-75.6	-64.7	49859
4	34 43.30	116 18.90	2126.50	979498.36	0.02	0.17	0.19	-83.2	-75.9	-65.1	50320
5	34 43.22	116 18.93	2121.10	979498.40	0.03	0.17	0.21	-83.3	-76.0	-65.2	50444
6	34 43.10	116 19.02	2120.60	979497.73	0.04	0.18	0.22	-83.9	-76.6	-65.8	50445
7	34 43.00	116 19.13	2097.80	979498.76	0.07	0.19	0.26	-84.0	-76.8	-66.1	50323
8	34 42.88	116 19.28	2059.30	979501.04	0.08	0.20	0.28	-83.8	-76.8	-66.3	50100
9	34 42.73	116 19.28	2030.60	979503.13	0.04	0.21	0.26	-83.3	-76.3	-66.0	50177
10	34 42.62	116 19.27	2023.30	979503.48	0.04	0.23	0.27	-83.2	-76.2	-65.9	49690
11	34 42.42	116 19.28	1977.80	979505.53	0.06	0.26	0.32	-83.5	-76.7	-66.7	50058
12	34 42.27	116 19.27	1952.30	979506.31	0.07	0.28	0.35	-84.0	-77.3	-67.4	50133
13	34 42.10	116 19.22	1927.40	979506.71	0.03	0.32	0.35	-84.9	-78.3	-68.5	50063
14	34 41.85	116 19.18	1904.90	979507.44	0.01	0.34	0.36	-85.1	-78.6	-68.9	50152
15	34 41.65	116 19.15	1896.30	979507.53	0.01	0.34	0.35	-85.3	-78.8	-69.2	50308
16	34 41.52	116 19.27	1890.00	979506.85	0.00	0.35	0.36	-86.1	-79.7	-70.1	50305
17	34 41.40	116 19.35	1887.90	979506.15	0.00	0.34	0.35	-86.8	-80.4	-70.8	50213
18	34 41.10	116 19.45	1887.50	979505.12	0.00	0.35	0.35	-87.3	-80.8	-71.2	50239
19	34 41.43	116 19.15	1892.80	979506.92	0.00	0.35	0.36	-86.5	-80.1	-70.5	50263
20	34 41.27	116 19.13	1899.50	979506.19	0.00	0.34	0.34	-85.9	-79.4	-69.8	50299
21	34 41.10	116 19.13	1902.40	979505.47	0.00	0.33	0.33	-86.2	-79.7	-70.1	50264
22	34 40.92	116 19.12	1904.50	979504.77	0.00	0.35	0.35	-86.5	-80.0	-70.3	50273
23	34 40.75	116 19.07	1902.30	979504.19	0.01	0.35	0.36	-87.0	-80.5	-70.8	50325
24	34 40.58	116 19.02	1896.10	979503.89	0.00	0.35	0.36	-87.4	-80.9	-71.3	50317
25	34 40.42	116 18.98	1892.20	979503.28	0.00	0.39	0.39	-88.0	-81.5	-71.9	50293
26	34 40.25	116 18.95	1891.90	979502.49	0.00	0.39	0.39	-88.6	-82.1	-72.5	50254

See footnotes at end of table

TABLE C-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.67	2.40	2.00	
27	34 40.08	116 18.93	1895.00	979501.44	0.00	0.39	0.39	-89.2	-82.7	-73.1	50226
28	34 39.92	116 18.97	1900.30	979500.17	0.00	0.42	0.42	-89.9	-83.4	-73.7	50180
29	34 39.78	116 19.07	1901.60	979499.02	0.00	0.41	0.42	-90.7	-84.2	-74.6	50157
30	34 39.65	116 19.18	1901.00	979498.08	0.00	0.41	0.41	-91.5	-85.1	-75.4	50152
31	34 39.52	116 19.33	1898.70	979497.21	0.00	0.41	0.41	-92.3	-85.9	-76.2	50162
32	34 39.42	116 19.47	1896.10	979496.74	0.00	0.45	0.45	-92.8	-86.3	-76.7	50154
33	34 39.30	116 19.68	1895.90	979495.67	0.00	0.51	0.51	-93.6	-87.2	-77.6	50146
34	34 39.18	116 19.88	1898.50	979495.05	0.00	0.51	0.51	-93.9	-87.5	-77.9	50036
35	34 39.08	116 20.07	1901.20	979494.58	0.00	0.51	0.51	-94.1	-87.6	-78.0	50179
36	34 38.87	116 20.23	1902.90	979494.07	0.00	0.58	0.58	-94.3	-87.8	-78.2	50099
37	34 38.88	116 20.38	1906.80	979493.53	0.00	0.58	0.58	-94.4	-87.9	-78.3	50067
38	34 38.80	116 20.55	1913.50	979492.99	0.00	0.65	0.66	-94.4	-87.9	-78.2	50109
39	34 38.68	116 20.73	1924.00	979491.91	0.01	0.73	0.74	-94.5	-88.0	-78.3	50030
40	34 38.58	116 20.90	1937.50	979490.48	0.01	0.74	0.75	-95.0	-88.4	-78.7	49986
41	34 38.50	116 21.07	1945.80	979489.59	0.03	0.75	0.78	-95.2	-88.6	-78.9	49807
42	34 38.38	116 21.23	1963.70	979488.12	0.02	0.78	0.79	-95.5	-88.8	-78.9	52043
43	34 38.25	116 21.37	1985.80	979486.24	0.01	0.86	0.87	-95.7	-89.0	-79.0	49834
44	34 38.13	116 21.48	2007.00	979484.83	0.02	0.91	0.93	-95.6	-88.8	-78.8	50225
45	34 38.02	116 21.58	2030.80	979483.01	0.03	0.91	0.94	-95.8	-89.0	-78.8	50103
46	34 37.92	116 21.73	2057.30	979481.22	0.03	0.93	0.96	-95.9	-88.9	-78.6	49690
47	34 37.82	116 21.77	2076.30	979479.93	0.04	0.91	0.96	-95.9	-88.8	-78.4	49824
48	34 38.18	116 19.72	1950.70	979490.43	0.02	0.65	0.66	-93.8	-87.2	-77.4	50104
49	34 38.32	116 19.83	1935.20	979491.12	0.01	0.65	0.66	-94.2	-87.7	-77.9	50117
50	34 38.52	116 19.90	1922.70	979491.92	0.00	0.58	0.58	-94.6	-88.0	-78.3	50095
51	34 38.68	116 19.97	1914.90	979492.49	0.00	0.57	0.57	-94.7	-88.2	-78.5	50089
52	34 38.83	116 20.05	1908.00	979493.17	0.00	0.58	0.58	-94.7	-88.2	-78.5	50003
53	34 38.97	116 20.13	1903.90	979494.10	0.00	0.57	0.57	-94.2	-87.7	-78.1	50145
54	34 38.78	116 20.85	1922.30	979492.51	0.00	0.74	0.74	-94.2	-87.7	-78.0	50002

See footnotes at end of table.

TABLE C-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.67	2.40	2.00	
55	34 38.92	116 20.77	1911.90	979493.66	0.00	0.67	0.68	-93.9	-87.4	-77.8	49874
56	34 39.08	116 20.67	1901.80	979494.84	0.60	0.60	0.60	-93.7	-87.2	-77.6	50056
57	34 39.32	116 20.53	1893.50	979496.47	0.59	0.59	0.59	-92.9	-86.5	-76.9	50174
58	34 39.47	116 20.68	1889.60	979497.67	0.00	0.55	0.55	-92.2	-85.8	-76.2	50203
59	34 39.62	116 20.88	1888.80	979498.86	0.00	0.63	0.63	-91.2	-84.7	-75.2	49916
60	34 39.78	116 20.95	1888.60	979499.65	0.00	0.64	0.64	-90.6	-84.2	-74.7	50163
61	34 39.95	116 21.03	1888.50	979500.64	0.00	0.64	0.64	-89.9	-83.4	-73.9	49911
62	34 40.13	116 21.12	1888.30	979501.52	0.00	0.59	0.59	-89.3	-82.9	-73.4	50033
63	34 40.28	116 21.15	1888.40	979502.37	0.00	0.59	0.59	-88.7	-82.2	-72.7	50070
64	34 40.43	116 21.20	1888.20	979502.90	0.00	0.60	0.60	-88.3	-81.9	-72.4	50105
65	34 40.60	116 21.23	1888.50	979503.58	0.00	0.55	0.55	-88.0	-81.5	-72.0	50405
66	34 40.80	116 21.35	1888.10	979504.21	0.00	0.57	0.57	-87.6	-81.2	-71.6	50406
67	34 40.95	116 21.43	1890.50	979504.69	0.01	0.63	0.63	-87.1	-80.7	-71.1	50213
68	34 41.15	116 21.53	1915.80	979503.34	0.02	0.56	0.57	-87.3	-80.8	-71.1	50154
69	34 41.30	116 21.60	1939.20	979503.20	0.05	0.53	0.59	-86.2	-79.6	-69.8	50185
70	34 41.45	116 21.67	1967.30	979500.68	0.06	0.51	0.57	-87.3	-80.6	-70.7	50151
71	34 41.63	116 21.75	1995.60	979499.09	0.05	0.44	0.48	-87.6	-80.8	-70.7	50157
72	34 41.77	116 21.83	2020.20	979497.62	0.06	0.42	0.48	-87.8	-80.9	-70.6	50160
73	34 41.92	116 21.92	2042.00	979496.33	0.07	0.40	0.47	-88.0	-81.0	-70.6	50202
74	34 42.08	116 22.02	2063.30	979495.05	0.06	0.43	0.49	-88.2	-81.1	-70.7	50196
75	34 42.20	116 22.12	2077.40	979494.51	0.06	0.38	0.44	-88.1	-81.0	-70.5	50186
76	34 42.33	116 22.22	2089.10	979494.09	0.07	0.37	0.44	-88.0	-80.9	-70.3	50139
77	34 42.48	116 22.37	2119.90	979492.95	0.08	0.35	0.43	-87.5	-80.3	-69.5	50144
78	34 42.60	116 22.48	2138.00	979492.43	0.10	0.33	0.43	-87.1	-79.8	-69.0	50086
79	34 42.75	116 22.63	2154.10	979492.99	0.09	0.28	0.37	-85.9	-78.5	-67.6	49988
80	34 42.85	116 22.78	2169.90	979491.42	0.07	0.31	0.38	-86.6	-79.2	-68.2	50097
81	34 42.95	116 22.93	2173.90	979491.80	0.07	0.30	0.37	-86.2	-78.7	-67.7	50121
82	34 43.07	116 23.12	2175.80	979492.13	0.06	0.29	0.35	-85.9	-78.5	-67.4	50074

See footnotes at end of table.

TABLE C-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.67	2.40	2.00	
83	34 43.17	116 23.37	2180.30	979491.64	0.07	0.33	0.40	-86.2	-78.7	-67.7	50055
84	34 43.20	116 23.57	2173.80	979491.49	0.06	0.34	0.40	-86.8	-79.4	-68.3	50084
85	34 43.22	116 23.78	2155.70	979492.65	0.09	0.31	0.40	-86.7	-79.4	-68.4	50326
86	34 43.25	116 23.97	2141.50	979493.36	0.09	0.36	0.45	-86.9	-79.5	-68.7	50373
87	34 43.27	116 24.17	2116.70	979494.39	0.09	0.39	0.48	-87.3	-80.1	-69.4	50370
88	34 43.30	116 24.37	2092.10	979495.69	0.10	0.42	0.52	-87.5	-80.3	-69.8	50226
89	34 43.32	116 24.57	2075.20	979496.58	0.05	0.44	0.49	-87.7	-80.6	-70.1	50199
90	34 43.35	116 24.83	2075.60	979495.92	0.02	0.48	0.50	-88.3	-81.2	-70.7	50065
91	34 43.42	116 25.02	2073.90	979496.13	0.02	0.48	0.50	-88.3	-81.2	-70.7	50639
92	34 43.50	116 25.25	2070.20	979496.28	0.04	0.48	0.52	-88.5	-81.4	-70.9	50107
93	34 43.60	116 25.42	2072.20	979496.18	0.03	0.53	0.56	-88.6	-81.5	-71.0	50246
94	34 43.73	116 25.58	2070.80	979496.36	0.03	0.52	0.55	-88.7	-81.6	-71.1	50169
95	34 43.85	116 25.72	2066.00	979496.78	0.03	0.45	0.48	-88.8	-81.7	-71.1	50160
96	34 43.50	116 25.32	2074.50	979495.84	0.04	0.53	0.58	-88.6	-81.5	-71.3	50238
97	34 43.33	116 25.28	2093.80	979494.31	0.07	0.54	0.61	-88.7	-81.5	-71.0	50127
98	34 43.18	116 25.23	2108.90	979493.24	0.09	0.55	0.64	-88.6	-81.4	-70.8	50126
99	34 43.02	116 25.18	2127.90	979492.08	0.08	0.56	0.61	-88.4	-81.4	-70.4	50120
100	34 42.88	116 25.13	2148.20	979491.21	0.08	0.56	0.64	-87.8	-80.5	-69.7	50112
101	34 42.70	116 25.08	2174.00	979490.52	0.06	0.57	0.63	-86.7	-79.3	-68.4	50113
102	34 42.55	116 25.05	2202.90	979489.15	0.07	0.63	0.70	-86.1	-78.6	-67.5	50071
103	34 42.40	116 25.00	2227.90	979487.72	0.07	0.63	0.70	-85.8	-78.2	-67.0	50163
104	34 42.23	116 24.97	2260.30	979485.20	0.08	0.65	0.72	-86.1	-78.4	-67.0	50159
105	34 42.07	116 24.88	2292.70	979483.46	0.07	0.69	0.75	-85.6	-77.8	-66.3	50184
106	34 41.87	116 24.83	2328.80	979481.37	0.08	0.71	0.78	-85.2	-77.3	-65.6	50060
107	34 41.77	116 24.67	2366.60	979478.44	0.10	0.66	0.76	-85.8	-77.7	-65.8	50073
108	34 41.62	116 24.55	2396.40	979476.55	0.15	0.62	0.77	-85.7	-77.5	-65.4	50124
109	34 41.50	116 24.42	2424.30	979474.11	0.19	0.63	0.82	-86.2	-78.0	-65.7	50193
110	34 43.75	116 25.93	2104.70	979493.99	0.06	0.56	0.62	-88.9	-81.6	-71.1	50201
111	34 43.65	116 26.15	2147.60	979491.01	0.07	0.54	0.61	-89.2	-81.9	-71.0	50166

See footnotes at end of table.

TABLE C-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.67	2.40	2.00	
112	34 43.57	116 26.33	2187.00	979488.63	0.05	0.53	0.59	-89.1	-81.7	-70.6	50129
113	34 43.47	116 26.53	2228.40	979486.09	0.07	0.53	0.59	-89.0	-81.4	-70.2	50109
114	34 43.33	116 26.45	2255.20	979484.67	0.07	0.52	0.59	-88.7	-81.0	-69.6	50130
115	34 43.22	116 26.33	2263.10	979484.04	0.09	0.59	0.68	-88.5	-80.8	-69.4	50138
116	34 43.08	116 26.20	2276.70	979483.23	0.09	0.59	0.68	-88.4	-80.6	-69.1	50155
117	34 42.98	116 26.10	2291.30	979482.56	0.12	0.58	0.70	-88.0	-80.2	-68.6	50173
118	34 42.82	116 26.17	2343.30	979479.35	0.13	0.58	0.70	-87.8	-79.9	-68.0	50240
119	34 42.63	116 26.23	2396.70	979475.87	0.12	0.63	0.75	-87.8	-79.6	-67.5	50257
120	34 42.48	116 26.30	2448.60	979472.39	0.12	0.63	0.76	-87.9	-79.6	-67.2	50232
121	34 42.32	116 26.38	2506.40	979468.27	0.13	0.64	0.77	-88.3	-79.8	-67.1	50234
122	34 42.13	116 26.45	2571.10	979463.70	0.13	0.68	0.81	-88.7	-80.0	-67.0	50222
123	34 42.00	116 26.58	2633.10	979459.60	0.13	0.70	0.83	-88.9	-79.9	-66.6	50191
124	34 41.87	116 26.63	2686.98	979455.98	0.10	0.73	0.84	-89.1	-79.9	-66.4	50180
125	34 41.75	116 26.78	2743.50	979452.31	0.11	0.75	0.86	-89.2	-79.8	-66.0	50166
126	34 41.63	116 26.90	2794.40	979449.05	0.12	0.77	0.89	-89.2	-79.6	-65.6	50150
127	34 41.47	116 27.02	2860.60	979445.28	0.11	0.78	0.90	-88.7	-79.0	-64.5	50145
128	34 41.28	116 27.10	2927.80	979441.81	0.15	0.82	0.97	-87.8	-77.8	-63.1	50091
129	34 41.13	116 27.17	2984.70	979439.01	0.17	0.83	1.00	-87.0	-76.8	-61.7	50056
130	34 41.00	116 27.27	3052.70	979434.54	0.17	0.82	0.99	-87.2	-76.8	-61.4	50052
131	34 40.85	116 27.32	3119.20	979430.12	0.20	0.84	1.04	-87.3	-76.7	-61.0	50004
132	34 40.77	116 27.17	3094.70	979431.99	0.25	0.85	1.10	-86.7	-76.2	-60.6	50029
133	34 40.58	116 27.12	3151.30	979428.22	0.27	0.83	1.10	-86.8	-76.1	-60.2	49993
134	34 40.37	116 27.12	3227.30	979423.27	0.30	0.80	1.10	-86.9	-75.9	-59.7	49927
135	34 40.22	116 27.07	3287.00	979419.12	0.24	0.79	1.03	-87.4	-76.2	-59.6	49944
136	34 40.00	116 27.03	3354.90	979414.12	0.17	0.76	0.93	-88.1	-76.7	-59.7	49892
137	34 39.88	116 26.95	3381.30	979412.28	0.13	0.71	0.84	-88.3	-76.8	-59.7	51747
138	34 39.68	116 26.85	3405.70	979409.89	0.09	0.69	0.79	-89.1	-77.4	-60.2	49846
139	34 39.52	116 26.73	3387.80	979409.89	0.11	0.63	0.75	-89.9	-78.4	-61.2	49800
140	34 39.38	116 26.62	3364.80	979410.78	0.08	0.57	0.65	-90.4	-78.9	-61.8	49760

See footnotes at end of table

TABLE C-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.67	2.40	2.00	
141	34 39.25	116 26.55	3348.60	979411.08	0.07	0.64	0.70	-90.8	-79.3	-62.4	49716
142	34 39.07	116 26.50	3331.10	979411.07	0.07	0.63	0.70	-91.6	-80.2	-63.3	49674
143	34 38.65	116 26.52	3315.60	979411.45	0.06	0.58	0.64	-91.9	-80.6	-63.8	49624
144	34 38.63	116 26.50	3307.00	979410.78	0.06	0.59	0.64	-92.8	-81.5	-64.7	49572
145	34 38.47	116 26.45	3296.50	979410.74	0.08	0.57	0.65	-93.2	-81.9	-65.2	49567
146	34 38.25	116 26.35	3284.50	979411.46	0.11	0.53	0.63	-92.9	-81.7	-65.1	49524
147	34 38.10	116 26.20	3262.40	979412.91	0.12	0.54	0.66	-92.6	-81.4	-64.9	49537
148	34 37.93	116 26.05	3241.20	979414.25	0.14	0.53	0.67	-92.3	-81.2	-64.7	49550
149	34 37.78	116 25.92	3217.00	979417.46	0.14	0.56	0.70	-90.2	-79.2	-63.0	49555
150	34 37.63	116 25.78	3189.60	979417.46	0.18	0.60	0.77	-91.6	-80.7	-64.5	49600
151	34 37.53	116 25.58	3156.60	979419.58	0.19	0.65	0.84	-91.2	-80.4	-64.5	49564
152	34 37.33	116 25.48	3121.90	979420.73	0.16	0.68	0.84	-91.9	-81.2	-65.4	49553
153	34 37.20	116 25.30	3079.80	979423.05	0.20	0.71	0.91	-91.8	-81.3	-65.7	49520
154	34 37.15	116 25.12	3048.50	979424.66	0.26	0.75	1.01	-91.8	-81.5	-66.1	49504
155	34 37.03	116 24.98	3010.00	979426.54	0.23	0.85	1.07	-92.0	-81.8	-66.6	49454
156	34 36.93	116 24.82	2967.50	979428.80	0.23	0.83	1.06	-92.2	-82.1	-67.1	49432
157	34 36.80	116 24.62	2919.90	979430.91	0.24	0.86	1.09	-92.7	-82.8	-68.1	49446
158	34 36.73	116 24.47	2885.90	979432.85	0.22	0.87	1.09	-92.7	-82.9	-68.4	49480
159	34 36.63	116 24.33	2848.10	979435.08	0.24	0.93	1.17	-92.5	-82.8	-68.5	49515
160	34 36.53	116 24.17	2805.00	979437.54	0.24	0.93	1.17	-92.5	-83.0	-68.9	49561
161	34 36.47	116 23.98	2764.60	979440.12	0.23	0.91	1.14	-92.3	-82.9	-69.0	49681
162	34 36.37	116 23.82	2725.10	979442.81	0.17	0.92	1.09	-91.9	-82.6	-68.9	49694
163	34 36.37	116 23.62	2679.10	979445.93	0.11	0.89	1.01	-91.6	-82.5	-69.0	49732
164	34 36.40	116 23.40	2627.90	979449.00	0.21	0.86	1.08	-91.6	-82.7	-69.4	49493
165	34 36.43	116 23.22	2587.20	979451.03	0.11	0.85	0.96	-92.2	-83.4	-70.4	49625
166	34 36.52	116 22.98	2536.60	979454.13	0.11	0.84	0.95	-92.3	-83.6	-70.9	49649
167	34 36.57	116 22.78	2495.20	979457.05	0.12	0.82	0.94	-91.9	-83.4	-70.9	49452
168	34 36.65	116 22.63	2454.50	979460.58	0.15	0.83	0.98	-90.9	-82.5	-70.2	50005
169	34 36.73	116 22.48	2413.70	979462.73	0.13	0.82	0.95	-91.3	-83.1	-71.0	49509

See footnotes at end of table.

TABLE C-1. (Contd.)

Station ID	Latitude[a]	Longitude[a]	Elevation, ft	Gravity,[b] mgal	Terrain correction,[c] 2.4 g/cm³			Complete Bouguer anomalies,[d] g/cm³			Corrected magnetics, gammas
					Inner zone	Outer zone	Total	2.67	2.40	2.00	
170	34 36.87	116 22.48	2390.90	979465.61	0.10	0.84	0.94	-90.0	-81.9	-69.9	49533
172	34 37.15	116 22.40	2306.70	979463.12	0.13	0.94	1.06	-91.8	-84.0	-72.4	49655
173	34 37.30	116 22.30	2254.40	979472.51	0.13	0.95	1.08	-91.7	-84.1	-72.8	49658
174	34 37.45	116 22.20	2201.30	979473.90	0.13	1.00	1.13	-93.7	-86.2	-75.2	49809
175	34 37.62	116 22.15	2150.70	979476.64	0.11	1.07	1.17	-94.1	-86.9	-76.1	49775
176	34 37.82	116 22.12	2094.40	979480.04	0.07	1.11	1.18	-94.4	-87.3	-76.9	49978
177	34 37.97	116 22.02	2055.50	979482.44	0.06	1.12	1.18	-94.5	-87.6	-77.3	49807
178	34 38.12	116 21.93	2023.60	979484.53	0.05	1.12	1.17	-94.6	-87.8	-77.7	49747
179	34 38.23	116 21.78	2003.00	979485.77	0.04	1.05	1.09	-94.8	-81.1	-78.1	49902
180	34 38.33	116 21.58	1981.70	979487.38	0.03	0.98	1.02	-94.7	-88.0	-78.1	50163
181	34 38.40	116 20.92	1952.00	979488.53	0.02	0.73	0.74	-95.8	-89.2	-79.4	49951
183	34 38.32	116 20.35	1949.90	979486.80	0.01	0.70	0.70	-95.6	-89.0	-79.2	50036
185	34 38.30	116 20.17	1948.30	979489.85	0.01	0.70	0.71	-94.6	-88.0	-78.2	50063
187	34 38.27	116 19.72	1945.30	979490.63	0.02	0.65	0.66	-94.1	-87.4	-77.6	50083
189	34 38.23	116 19.27	1970.50	979490.89	0.02	0.58	0.60	-92.3	-85.6	-75.7	50001
191	34 38.27	116 18.85	1392.70	979491.27	0.01	0.56	0.58	-90.7	-83.9	-73.8	50083
193	34 38.25	116 18.38	2037.10	979490.40	0.04	0.50	0.54	-88.9	-82.0	-71.7	50031
195	34 38.22	116 17.93	2092.60	979488.55	0.04	0.45	0.49	-87.5	-80.3	-69.7	50017
197	34 38.20	116 17.53	2135.30	979487.09	0.05	0.42	0.47	-86.4	-79.1	-68.3	50008
199	34 38.18	116 17.15	2178.60	979485.17	0.06	0.39	0.45	-85.7	-78.2	-67.2	50007
201	34 38.28	116 16.83	2202.60	979483.50	0.06	0.38	0.44	-86.1	-78.5	-67.4	50313
203	34 38.77	116 17.07	2126.50	979489.16	0.03	0.37	0.41	-85.7	-78.4	-67.6	50033
205	34 39.05	116 17.35	2088.50	979490.38	0.02	0.34	0.36	-87.2	-80.1	-69.5	50080
207	34 39.32	116 17.63	2045.40	979492.08	0.03	0.36	0.39	-88.4	-81.4	-71.1	50029
209	34 39.57	116 17.97	1991.40	979495.67	0.04	0.34	0.38	-88.5	-81.6	-71.6	50177
211	34 39.78	116 18.28	1955.50	979498.05	0.02	0.37	0.40	-88.5	-81.8	-71.9	50172
213	34 40.02	116 18.62	1920.70	979500.39	0.02	0.35	0.37	-88.6	-82.1	-72.3	50221

[a] Latitude and longitude from state-plane coordinates, AK Zone 10
[b] Drift-corrected observed gravity
[c] Terrain correction
[d] Bouguer anomalies use the 1930 formula for latitude corrections

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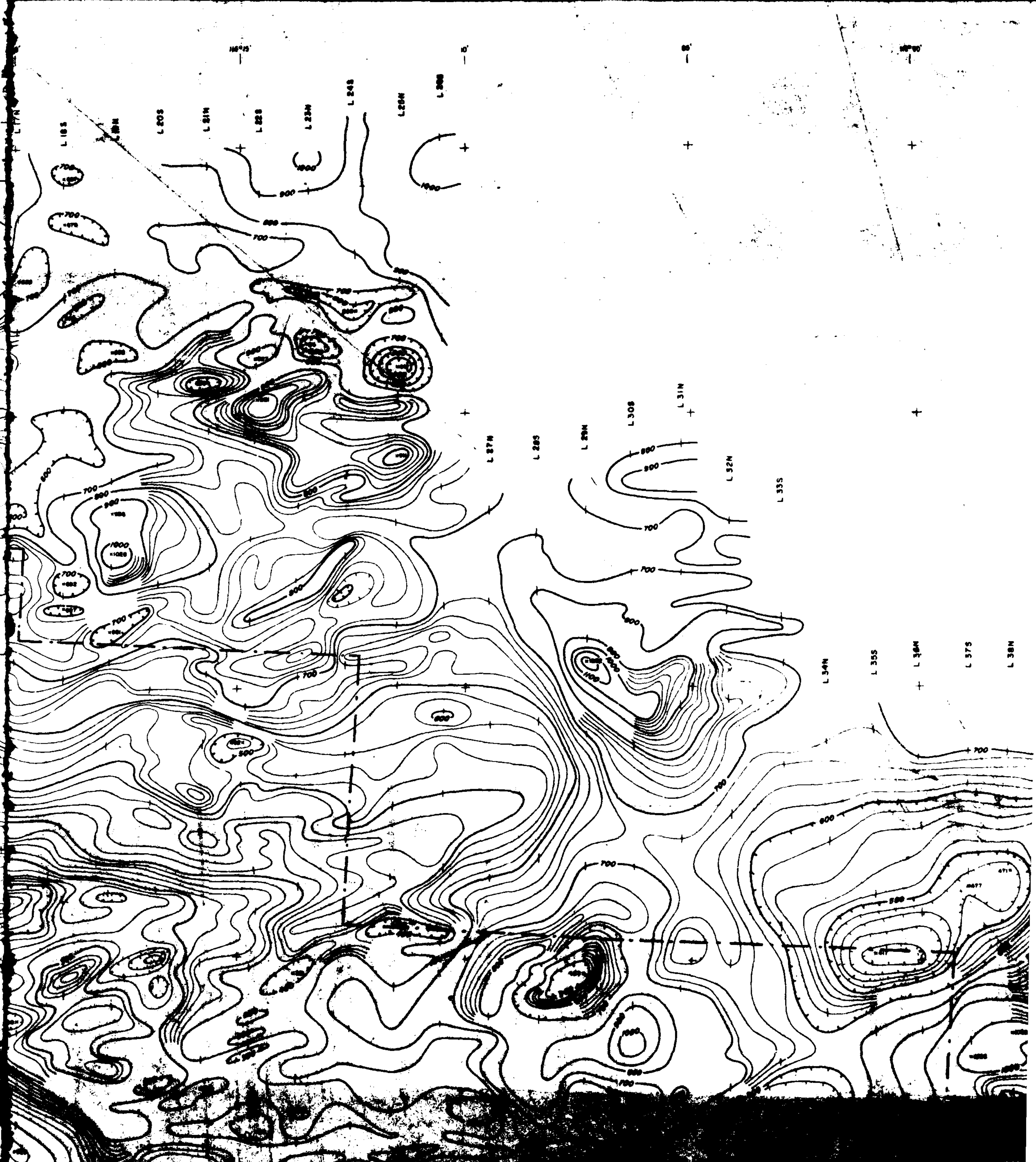

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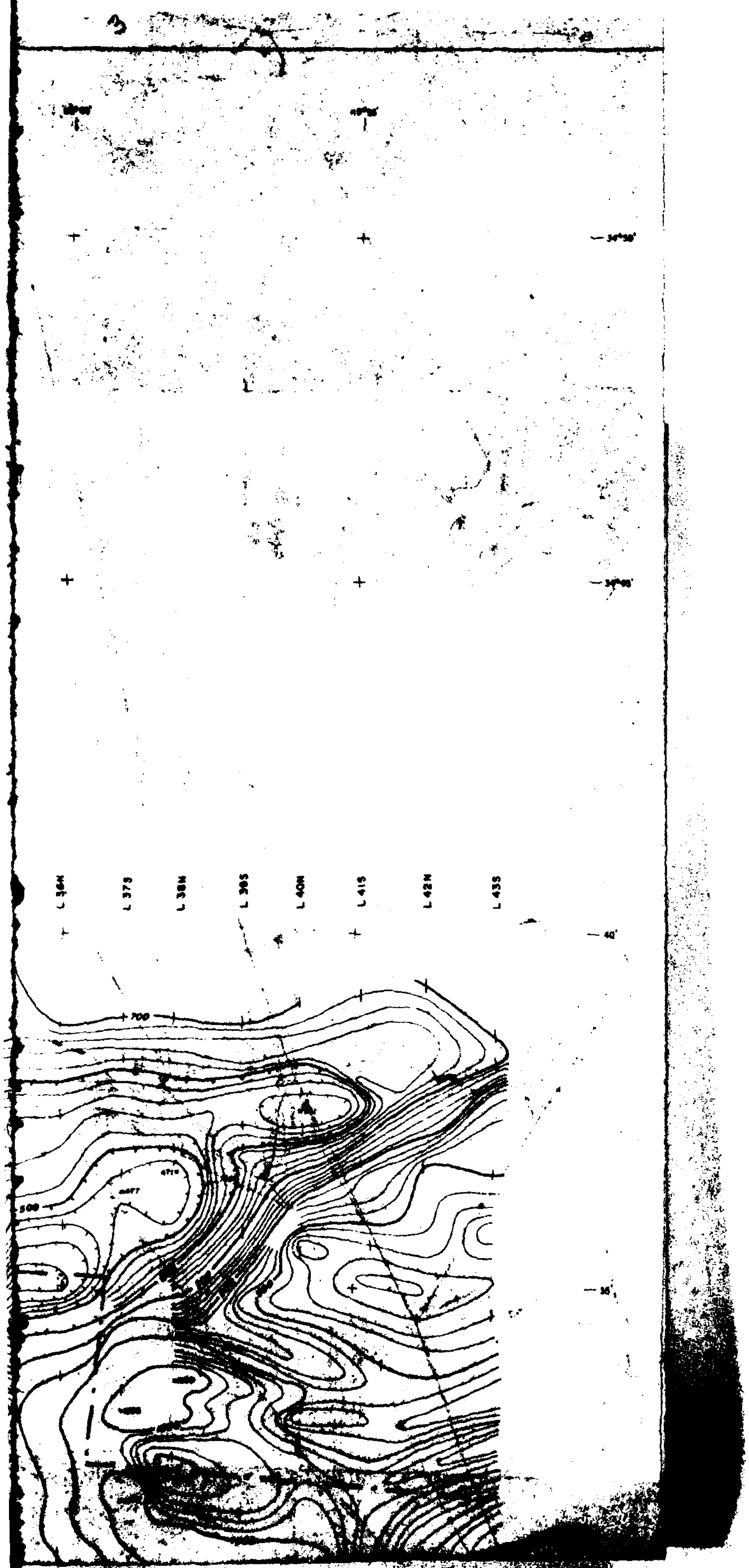
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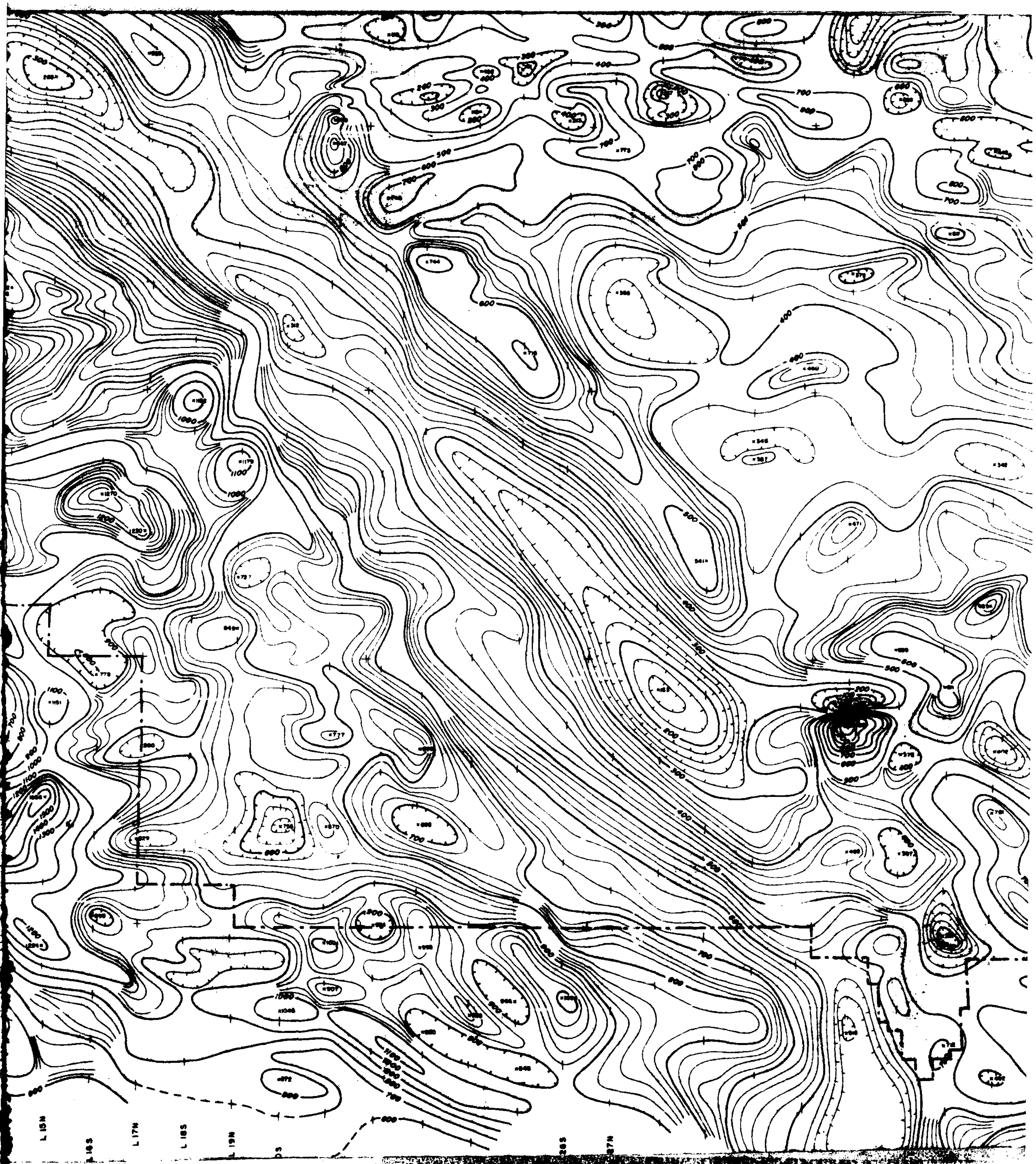
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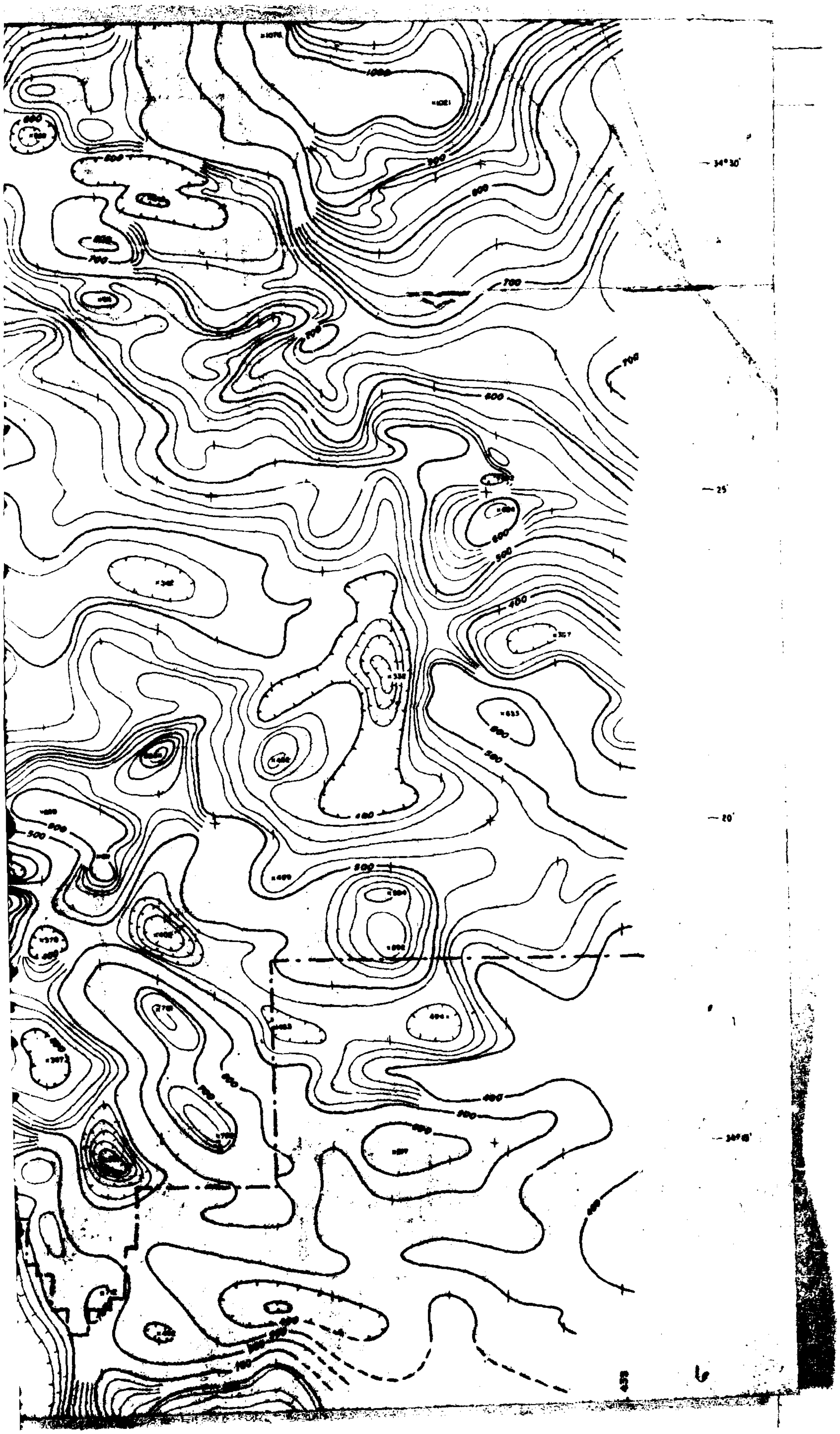

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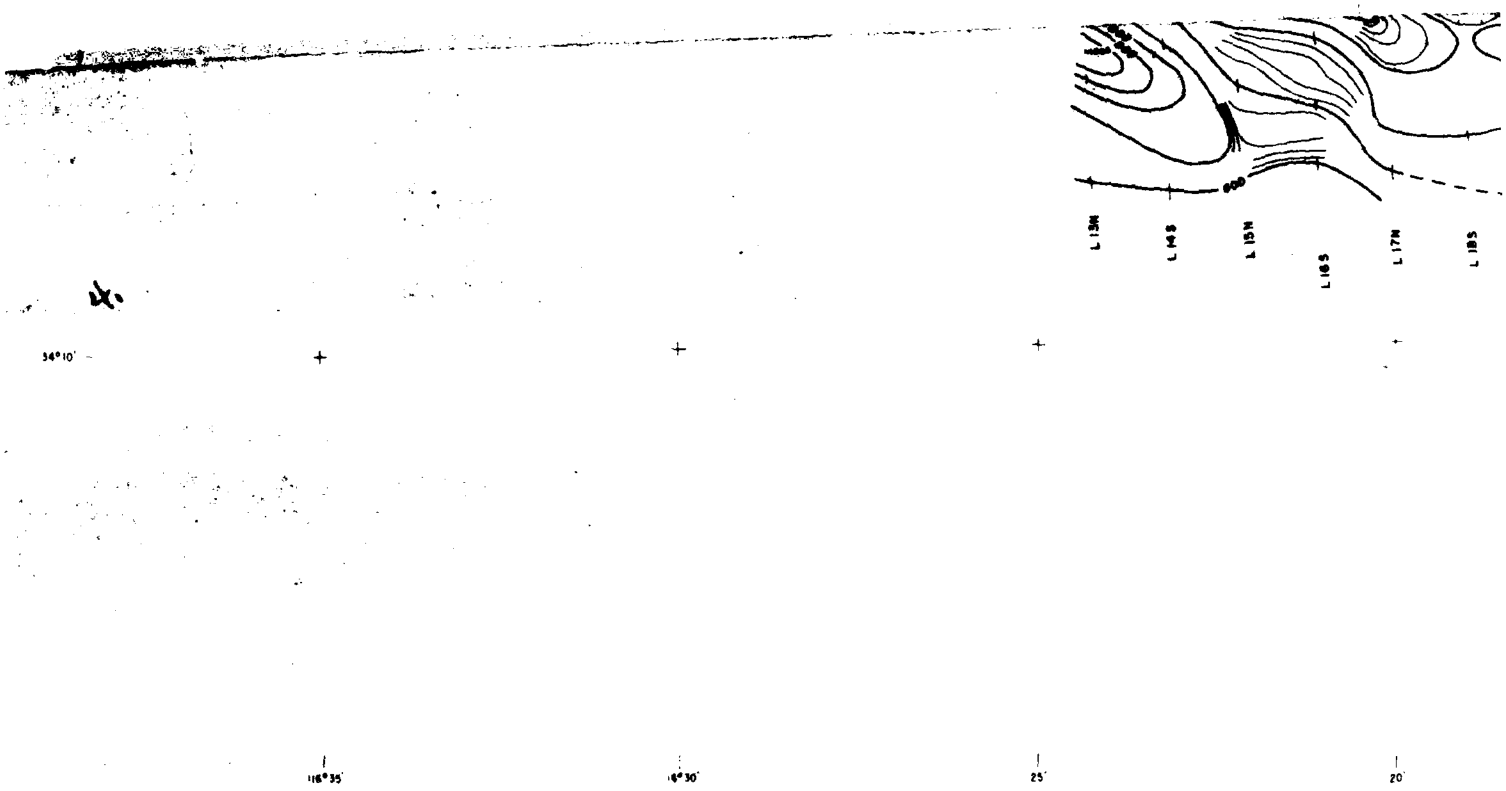


SURVEY SPECIFICATIONS —

Flight Line Direction: North – South

Flight Line Spacing: Approximately one mile

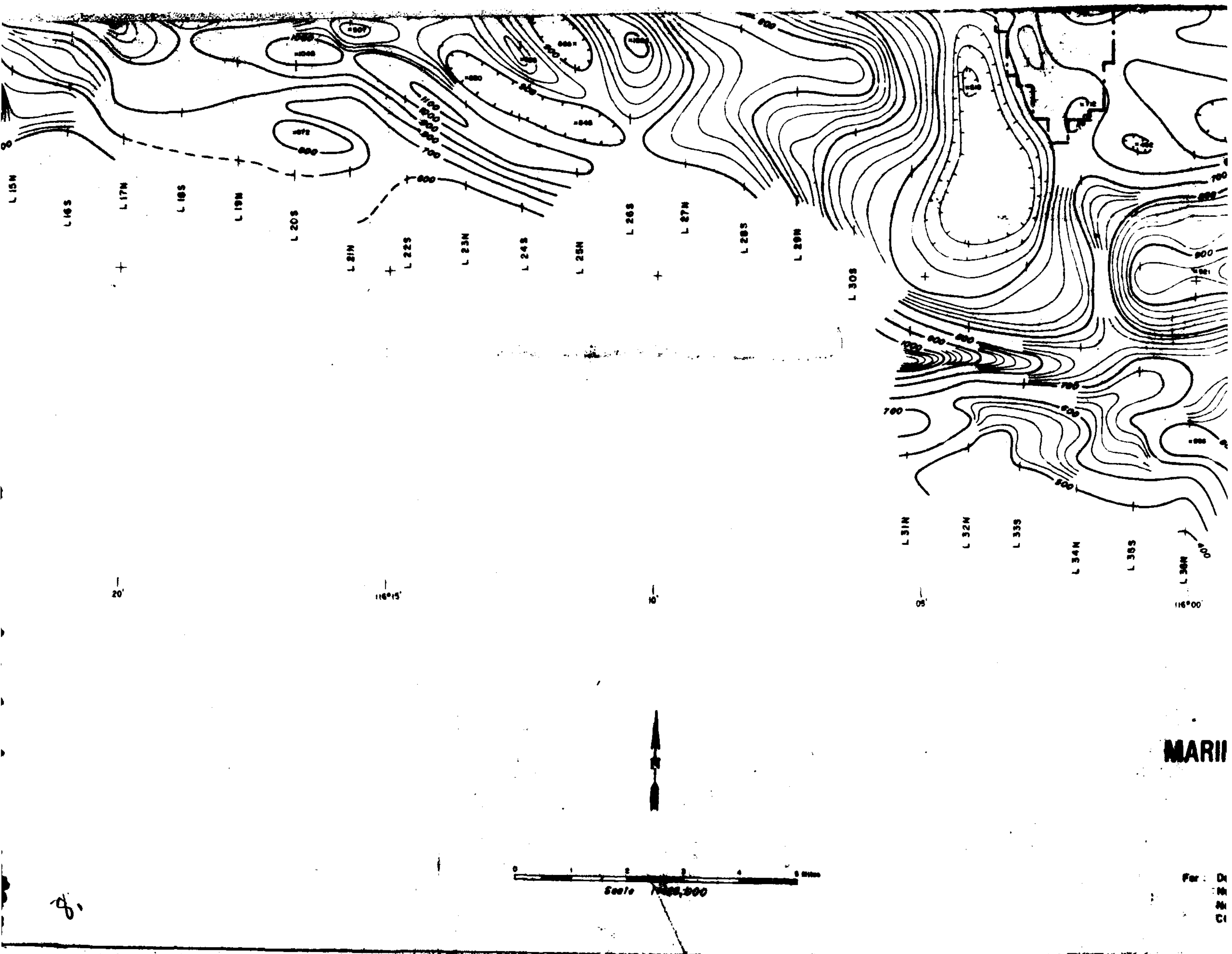
Mean Terrain Clearance: 1000 feet

Contour Interval: 20 gammas locally, 100 gammas overall

Dates Flown: September 24, 25, 26, 1982

Flown By: Aerial Surveys, Ltd.

Contour values are diurnal drift corrected total magnetic field strength in gammas minus 48,900 gammas.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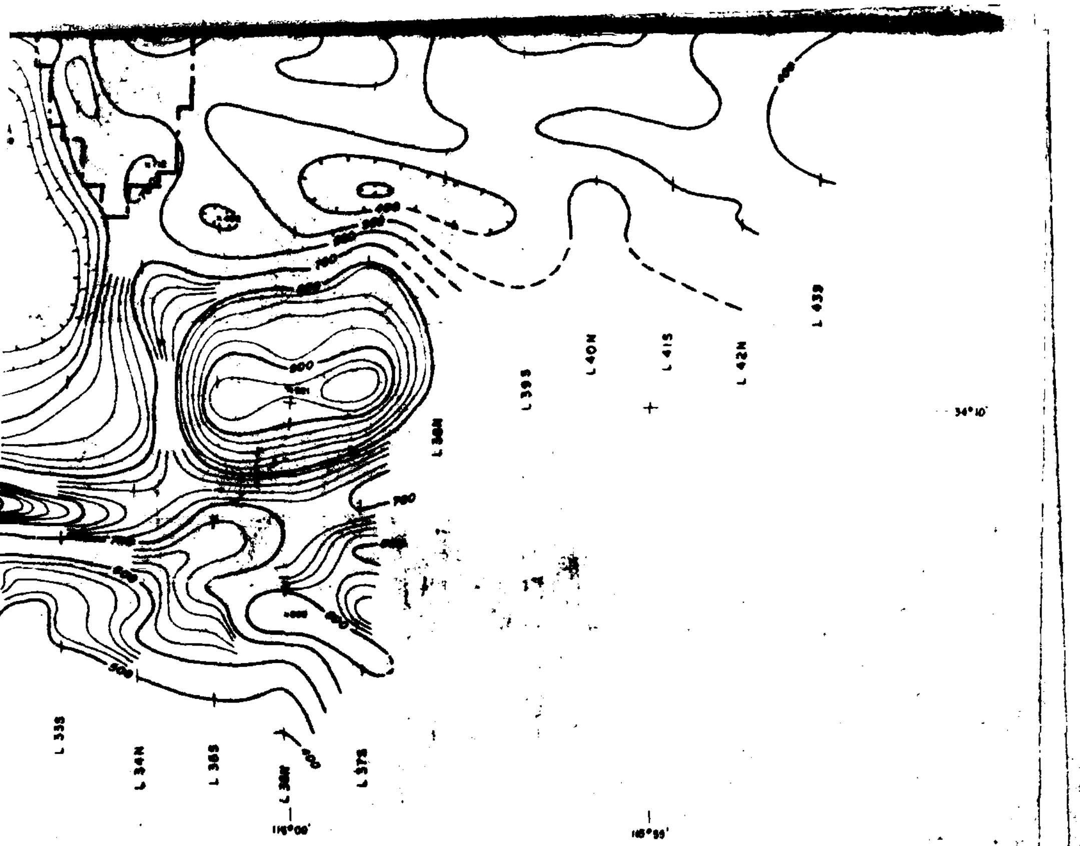

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AEROMAGNETIC SURVEY
MARINE CORPS AIR GROUND COMBAT CENTER
TWENTYNINE PALMS, CALIFORNIA

CONTRACT NO. N62474-82-C-C278

For: Department of the Navy
Naval Facilities Engineering Command
Naval Weapons Center
China Lake, California

By: [illegible]